Indira Gandhi National Open University
School of Sciences

MGG - 003

REGIONAL GEOGRAPHY OF INDIA

BLOCK

3

MACRO REGIONS

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UNIVERSITY

BLOCK 3: MACRO REGIONS

Macro regions are known as regions of immense size. These often tend to spread over large area covering more than one or two states on the basis of homogenous criteria like physiography, climate or some socio-cultural traits. Their study provides a regional geographer with in-depth understanding of both physical and cultural setting which in turn helps to delineate the regions on the basis of various parameters. They also help in unleashing the problems and prospects to deal with both set of resources as well as constraints alike.

In third Block, we will introduce macro regions of India. This Block will include the study of macro regions of India 1, 2 and 3 as dealt-in an elaborative manner in three units.

Unit 8: Eighth Unit is devoted to the study of macro regions of India 1. This Unit introduces the Himalaya and its associated mountain ranges. It will highlight the historical background, physical and cultural setting and sub-regions along with problems and prospects.

Unit 9: Ninth Unit is devoted to the study of macro regions of India 2. This Unit introduces the Indo-Ganga and Brahamputra plains. It will highlight the historical background, physical and cultural setting, regions along with problems and prospects.

Unit 10: Tenth Unit is devoted to the study of macro regions of India 3. This Unit introduces the Peninsular India and Islands. It will highlight the historical background, physical and cultural setting, regions along with problems and prospects. .

We hope that after studying Block 3, you will be able to comprehend the few select macro regions of India in a better manner.

Our best wishes are always with you in this endeavour.

MGG- 003
REGIONAL GEOGRAPHY OF INDIA

UNIT 8

MACRO REGIONS OF INDIA 1

Structure

8.1 INTRODUCTION

In three Units of Block 2, you have studied and learned about the schemes of regionalisation. In Block 3, you will study macro-regions of India. This Unit 8 is devoted to the study of Himalayas and its associated mountain ranges. The word Himalayas is derived from Sanskrit words Hima, “snow,” and ‘alaya’, “abode”. This loftiest mountain system of the world forms northern limits of India. It forms a great arc of about 1,550 miles (2,500 kilometres) long, stretching from the peak of Nanga Parbat at an altitude of 26,660 feet in the Pakistani-occupied portion of Kashmir region to Namcha Barwa peak in Tibet Autonomous Region of China. Geographically, the mountains fall across India, southern Tibet, Nepal and Bhutan. Overall width of the mountain system varies between 200 and 400 kilometres.

Within India, the Himalayas are divided into three longitudinal belts, known as the Outer, Lesser, and Greater Himalayas. Most of the mountain ranges in the west lie in Afghanistan and Pakistan while the central and eastern parts of

it lie within India. Towards north of the Himalayas are plateau of Tibet and various Trans-Himalayan ranges, only a small part of which is in Ladakh Union Territory and Spiti in Himachal Pradesh and a few other small stretches are within India. Location map of Himalaya and its associated mountain ranges are shown in Fig. 8.1.

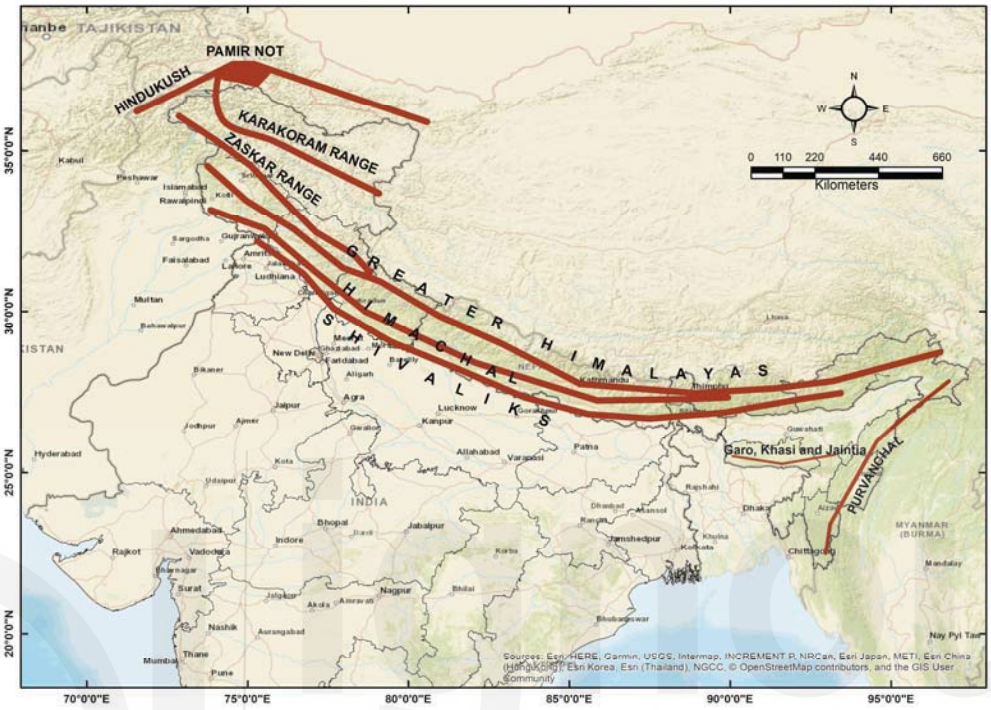

Fig. 8.1: Himalayas and its Associated Mountain Ranges.
(Source: ESRI, HERE, Garmin, USGS, Intrermap)

Section 8.2 describes the historical background of the Himalaya and its associated mountain ranges. Sections 8.3 to 8.6 are devoted to the study of Physical Settings, Cultural Settings, Regions, Problems and Prospects etc.

Expected Learning Outcomes

After studying this unit, you should be able to:

- examine a brief history of Himalaya and its associated mountain regions;
- understand the nature of physical setting of Himalaya and its associated mountain regions;
- understand the nature of cultural setting in Himalaya and its associated mountain regions;
- explore the regions of Himalaya and its associated mountain ranges; and
- comprehend the problems and prospects of Himalaya and its associated mountain regions.

8.2 HIMALAYA AND ASSOCIATED MOUNTAIN RANGES: HISTORICAL BACKGROUND

Himalayan Mountains form one of the most important regions of India. Its geography, geological settings, historical evolution, political boundaries, population base, resources, and economy can be a separate entity in

understanding it as a macro-region of India. It has a rich diversity of flora and fauna and forms the base and life support system for a large part of the country in terms of forest and water resources, mineral resources, and resources of various other kinds. Hence, this unit deals with Himalayan region as a macro-region and tries to understand its diversified characteristics ranging from physical settings, cultural settings, regions along with problems and prospects associated with it.

8.3 HIMALAYA AND ASSOCIATED MOUNTAIN RANGES: THE PHYSICAL SETTING

In terms of physical setting, Himalayas can be sub-divided into three major divisions and their geographical attributes can be understood in the following divisions:

A) The Himalayan Ranges
B) The Trans Himalayas
C) The Eastern Himalayas

A) The Himalayan Ranges

Himalayas are not a single chain of mountains but a series of ranges that run parallel or are converging ranges. These ranges are separated by deep valleys. The most outstanding valleys in Himalayas are the Vale of Kashmir, Kangra and Kullu valleys in Himachal Pradesh, Dun valley, the Bhagirathi valley (near Gangotri), and Mandakini valley (near Kedarnath) in Uttarakhand and Kathmandu valley in Nepal. In Eastern section, Himalayas rise abruptly from the plains of Bengal and attain great elevation within a short distance from the foot of the mountains. For instance, peaks of Kanchenjunga and Everest are only a few kilometres from the plains and are visible from the plains. While the Western Himalayas rise gradually from the plains through a series of conspicuous mountain ranges. Most of the Himalayan ranges fall in India, Nepal, and Bhutan while the northern slopes are partly situated in Tibet. Its Western extremity lies in Pakistan, Afghanistan and Central Asia. The succession of three zones can be seen in the Himalayan ranges:

i) Outer Himalayas or Shiwalik Range,
ii) Middle or the Lesser Himalayas,
iii) Great Himalaya

i) Outer Himalayas (the Shiwalik Range)

Southernmost of the three mountain belts is Outer Himalayas, also known as Siwalik or Shiwalik range. Width of Shiwaliks varies from 50 kilometres in the western and central parts to less than 15 kilometres in eastern part. Height of peaks of the Siwalik range varies between 600 to 1500 metres. Shiwaliks are of great thickness of Mio-Pleistocene sands, gravels, and conglomerates which have been brought by the rivers flowing from higher ranges of Himalayas. Shiwaliks are known by different names in different areas. They are called Jammu hills in Jammu, Miri, and Abor, etc. The Dhang range, Dundwa range (Uttarakhand), and the Churia Ghat hills of Nepal also form part of Shiwalik range.

As Shiwalik hills were formed after the formation of Himalayas, these obstructed courses of the rivers flowing from higher reaches of Himalayas and formed temporary lakes. Debris brought by those rivers was deposited in these lakes. After the rivers had cut their course through Shiwalik range, the lakes got drained away leaving behind plains known as ‘duns’ or ‘doons’ in the west and ‘duars’ in the east.

There are several opinions regarding the origin of Shiwalik. Following are the major concepts concerning the formation of Shiwalik hills:

a) **Formation of Shiwalik by Natural Levees**: According to this concept after the formation of Greater and Lesser Himalayas, the Tethys sea was reduced to a narrow channel which was also named ‘Shiwalik River’ by G.E. Pilgrim and, ‘Indobrahama River’ by E.H. Pascoe (1919). This river deposited a huge quantity of debris along the banks in the form of Natural Levees. The compression of these levees during Pliocene period due to earth's movement gave rise to the Shiwalik folds. However, there are criticisms concerning this concept as the force of compression cannot produce an altitude ranging between 1200-1800 metres.

b) **Coalescence of Alluvial Fans of Himalayan Rivers:** This theory emphasises the formation of Shiwalik due to deposition of sediments brought down by Himalayan rivers which were deposited in large quantities in the form of alluvial fans. Several alluvial fans later joined and formed larger fans which were subjected to earth movement in the Pliocene period and it was compressed to Shiwalik ranges.

c) **Shiwalik Formation by Lake Siltation:** According to this theory after formation of Himalayas, the Tethys sea was broken into several smaller lakes of varying sizes and shapes. Debris brought down by Himalayan rivers were deposited in these lakes. Sudden geological movements in Pliocene uplifted these lakes and folds were formed resulting in the formation of Shiwalik ranges.

d) **Plate Tectonics resulting in Shiwalik Formation:** As per this concept, the Shiwalik formation had its origin in the subduction of Indian plate over the Asian plate. The stress generated resulted in the formation of foredeep like the Ganga plain. Its alluviation and folding resulted in the formation of Shiwalik hills.

ii) Middle or Lesser Himalayas

In between Shiwaliks in South and Great Himalayas in the North lies the Middle or the Lesser Himalayas rising to heights ranging from 3,500 metres to 4,500 metres above mean sea level. Its average width varies between 60 to 80 kilometres. Many peaks in the middle Himalayas are more than 5050 metres above mean sea level (MSL) and remain snow-covered throughout the year. Important ranges in middle Himalayas include Pir Panjal, Dhauladhar, Mussoorie range, Nag Tiba, and Mahabharat Lekh. Pir Panjal range in Jammu and Kashmir is the longest and most important of all ranges that extends for 300-400 kilometres and is separated from Great Himalayan range by valley of Kashmir. There are numerous passes in Middle Himalayas. Best-known passes of Pir Panjal range are Pir Panjal Pass (3480 metres), the

Bidil (4270 metres), Golabghar Pass (3812 metres), Banihal Pass (2835 metres) and Rohtang Pass (3978 metres).

On the whole, middle Himalayas are less hostile and are more suitable for human inhabitation. Majority of the hill stations like Shimla, Mussoorie, Ranikhet, Nainital, Almora and Darjeeling, etc. are located in Middle Himalayas.

iii) Great Himalayas

Further north of Middle Himalayas lies the Great, or Higher Himalayas, also known as Himadri in Ancient times. Average elevation is 6100 metres above mean sea level in this range. Great Himalayas is composed of ancient crystalline rocks (granite and gneisses) and old marine sedimentary formations. This is the loftiest and most continuous mountain range. This mountain range has most of tallest peaks in the world, which remain perpetually snow covered. There are several peaks above 8000 metres in altitude in this range. Some of the highest peaks in the world found in Great Himalayan range include Mt. Everest (8850 metres), Kanchenjunga (8550 metres), Nanda Devi (7817 metres), Kamet (7755 metres) and Trisul (7120 metres), etc. Many of the world's highest peaks are shared by India and Nepal, which are mostly covered with glaciers, thus, forming source of many perennial mountain rivers. These rivers often serve as a lifeline for the inhabitants of downstream usually located in the plain regions, especially in case of agricultural activities.

This range is so formidable that it cannot be easily crossed as most often the passes remain snowbound during large part of the year. Burzil Pass, Zoji-La Pass in Jammu and Kashmir, Bara Lacha Pass and Shipkila Pass in Himachal Pradesh, Thaga-La Pass, Niti Pass and Lipu Lekh in Uttarakhand and Nathu-La and Jelep-La in Sikkim are important mountain passes of the Great Himalayan range.

B) The Trans Himalayas

The ranges to the North of Great Himalayan range are called the trans-Himalayas. This part of Himalayas is also called Tibetan Himalayas as most of it lies in Tibet. Zanskar, Ladakh and Karakoram are main ranges of Trans Himalayan zone. Trans Himalayan area found in India is mostly limited to Ladakh and Spiti regions. It stretches for a distance of about 1000 kilometres in the east-west direction and its average elevation is 3000 metres above mean sea level.

Northernmost range of Trans-Himalaya in India is Karakoram range also known as Krishnagiri range. It forms India’s frontier with Afghanistan and China and acts as a watershed between India and Turkistan. It extends eastward from Pamir knot for about 800 kilometres. Average width of this range is about 120-140 kilometres. Some of the peaks are more than 8000 metres above mean sea level. K2 (8611 metres) is the second-highest peak in the world. The other peaks located in its neighbourhood and rising more than 8000 metres above sea level are Gasherbhum I or Hidden Peak (8068 metres), Broad Peak (8047 metres), and Gasherbhum II (8035 metres). Ladakh plateau lies to the south of Karakoram range. With an average

elevation of over five thousand metres above mean sea level, it is the highest plateau in India. It has been dissected into several plains and mountains, the most outstanding among these being Soda plains, Aksai Chin, Lingzi Tang, Depsang plains, and Chang Chenmo.

C) Eastern Hills or Purvanchal

Himalayas take a southward turn after crossing Dihang Gorge and forms a series of low hills running in the shape of Crescent with its convex side pointing towards west. These hills are collectively called Purvanchal, as these form eastern margin of India. These form India's boundary with Myanmar from Arunachal Pradesh in the North and Mizoram in the South.

In the north of Patkai Bum, these forms international boundary between Arunachal Pradesh and Myanmar. These are made up of strong sandstone and rises to elevation varying between 2000 to 3000 metres. After running for a certain distance, these merge with Naga hills. Patkai hills and Naga hills form watershed between India and Myanmar. South of Naga hills are Manipur hills which are generally below 2500 metres in elevation and form boundary between Manipur and Myanmar. South of Manipur hills are Mizo hills previously known as Lusai hills having elevation of about 1500 metres. Highest point is the Blue Mountains (2157 metres) in the south. General elevation of Eastern hills decreases as one moves from North to South.

Regional Division of Himalayas

Himalayas have been divided into several units based on their structural and regional characteristics. Sir Sydney Burrad (Tiwari, R.C. 2012, p. 60) divided it into four transverse regions viz., the Punjab Himalayas, the Kumaon Himalayas, the Nepal Himalayas, and the Assam Himalayas. The Punjab Himalaya is now known as Himachal Himalaya. Similarly, the Assam Himalaya is known as Arunachal Himalaya.

S.P. Chatterjee has divided the Himalayan region into three mesographic regions. These are Western Himalayas (Kashmir, Punjab, and Kumaon), Central Himalayas (mostly Nepal Himalayas), and Eastern Himalayas (beyond Nepal till Arunachal Pradesh).

Similarly, R.L. Singh (1971) has made a three-fold sub-division of the Himalayas as under:

i) Western Himalaya (Kashmir Himalaya and Himachal Himalaya)
ii) Central Himalaya (UP Himalaya and Nepal Himalaya)
iii) Eastern Himalaya (Darjeeling-Bhutan-Assam Himalaya and Purvanchal)

The entire length of the Himalayas can be understood into the following four Divisions based on the river valleys:

i) The Punjab Himalayas

The total stretch of about 560 kilometres long of Himalayas between Indus and Satluj rivers is known as Punjab Himalayas. A large portion of this sector lies in Jammu and Kashmir and Himachal Pradesh, which is also referred to as Kashmir and Himachal Himalayas. Many mountain ranges fall in this category including Karakoram, Ladakh, Zanskar, Pir Panjal, and Dhauladhar.

ii) The Kumaon Himalayas

Between Satluj and Kali rivers is Kumaon Himalaya, which extends for about 320 kilometres. General elevation of Kumaon Himalayas is greater than that of Punjab Himalayas. Major Mountain peaks including Nanda Devi, Kamet, Trisul, Badrinath, Kedarnath, and Gangotri fall in this unit.

iii) The Nepal Himalayas

This section of Himalayas extends between river Kali and Teesta for a distance of about 800 kilometres. Most of it lies in Nepal due to which it derives its name as Nepal Himalayas. This is the tallest section of Himalayas. Major mountain ranges like Mount Everest, Kanchenjunga, Lhotse I, Makalu, Annapurna, and Dhaula Giri lie in this region of the Himalayas.

iv) The Assam Himalayas

Himalayan ranges from rivers Teesta to Brahmaputra that covers a total length of about 750 kilometres are known as Assam Himalayas. Sikkim and Arunachal Pradesh come under Assam Himalayas. Southern slopes are steep while the northern slopes are gentler in this region.

Assam Himalaya and Punjab Himalaya are old terms. Contemporary terms for these sections are Arunachal Himalaya, and Jammu and Kashmir and Himachal Himalaya; it is because Arunachal was part of the undivided Assam. Similarly, Himachal was part of the undivided Punjab, before the formation of full State in 1971.

8.3.1 Geology

In order to understand Geology, one must first understand geological history of Earth's crust and major events that had occurred in the past. Around 65 million years ago, powerful global plate-tectonic forces moved Earth's crust to form the band of Eurasian Mountain ranges-including the Himalayas-that stretch from Alps to the mountains of Southeast Asia.

During Jurassic Period (about 201 to 145 million years ago), a deep crustal down warp-the Tethys sea-bordered entire southern fringe of Eurasia, then excluding Arabian Peninsula and Indian sub-continent.

About 180 million years ago, the old supercontinent of Gondwana began to split apart. The Indian-Australian plate gradually confined the Tethys trench due to compression between itself and Eurasian Plate. As the Tethys trench narrowed, increasing compressive forces bent layers of sediments beneath it and developed faults in its marine sediments. Masses of granites and basalts intruded from the depth of the mantle into that weakened sedimentary crust.

Between about 40 and 50 million years ago, Indian sub-continent finally collided with Eurasian plate. The plate containing India got subducted beneath the Tethys.

During next 30 million years, shallow parts of the Tethys sea gradually drained as its sea bottom was pushed up by the plunging Indian-Australian plate; that action formed plateau of Tibet. As heavy rain fell on steepening southern slopes, the major southern rivers eroded northward toward the

headwaters with increasing force along old transverse faults and captured the streams flowing onto the plateau, thus laying the foundation of the drainage patterns for large portion of Asia.

To the south, the northern reaches of Arabian sea and Bay of Bengal were rapidly filled with debris carried down by the antecedent Indus, Ganges (Ganga), and Brahmaputra rivers. The extensive erosion and deposition continue even now as these rivers carry immense quantities of loose and unconsolidated material every day.

Finally, some 20 million years ago, during early Miocene Epoch, tempo of the crunching union between the two plates increased sharply, and Himalayan Mountain building began rapidly. As Indian sub-continental plate continued to plunge beneath the former the Tethys trench, topmost layers of old Gondwana metamorphic rocks peeled back over themselves for a long horizontal distance to the south, forming nappes. A wave after wave of nappes thrusted southward over Indian landmass for as far as about 100 kilometres. Each new nappe consisted of Gondwana rocks older than the last. In time those nappes became folded, contracting the former trench by some 800 kilometres. Along with it, down-cutting rivers matched the rate of uplift, carrying vast amounts of eroded material from rising Himalayas to plains where it was dumped by Indus, Ganges and Brahmaputra rivers.

Weight of those sediments created depressions, which in turn could hold more sediments. In some places, alluvium beneath Indo-Gangetic plains goes up to 7,000 metres in depth.

After formation of Great Himalayas, it became climatic barrier thereby obstructing rain-bearing winds to cross across. Rivers of large volume and size are formed by melting glaciers. Simultaneously, great transverse rivers breached Himalayas and continued their downcutting in pace with the upliftment.

Formations of Siwalik Series were overthrust and folded, and in between the Lesser Himalayas downward to shape the midlands.

8.3.2 Physiography/Relief

Important characteristic features of Himalayas are their great height, steep-sided peaks, valleys and alpine glaciers of large size. There are deep gorges cut by fast-flowing rivers. Himalayas also have complex geologic structure and series of elevation belts (or zones) that display different ecological association with flora, fauna and climate.

Himalayas appear as a gigantic crescent with the main axis rising above snow line. Large snowfields and alpine glaciers in turn constitute sources of most of the Himalayan rivers. Greater part of Himalayas, however, lies below snow line. Mountain-building process that created the range is still active. As the bedrock gets lifted, considerable stream erosion and gigantic landslides occur.

In nutshell, Himalayan ranges can be grouped into four longitudinal mountain belts of varying widths, each having distinct physiographic features and geologic history. From south to north, they can be divided as Outer or Sub-Himalayas (also called the Siwalik range); Lesser or Lower Himalayas; Great

Himalaya range (Great Himalayas); and Trans-Himalayas. Farther north lies Tibet proper. From west to east, Himalayas are divided broadly into three mountainous regions: western, central, and eastern.

8.3.3 Drainage and Water Resources

Himalayas are source of many perennial rivers which drains into Bay of Bengal and Arabian sea. There are large number of perennial rivers that have their source in snowfields and glaciers in Himalayas, of which more than 70 percent of India's territory drains into Bay of Bengal via the Ganges-Brahmaputra river system and several large and small peninsular rivers while majority of India's Peninsular States do not have share of Himalayan rivers as most Himalayan rivers flow in northern plains. Areas draining into Arabian sea, accounting for about 20 percent of the total lie within Indus drainage basin situated in the north-western India.

Three major river systems namely Indus, Ganges and Brahmaputra comprise the Himalayan river systems in India. Some of the rivers of this system existed before Himalayan ranges got uplifted. Very deep gorges of Indus, Satluj, Alaknanda, Gandak, Kosi and Brahmaputra rivers indicate their being antecedent rivers. It means that these rivers existed when Himalayas were rising. Himalayas are the source of many perennial rivers which drain into Bay of Bengal and Arabian sea. Most of these rivers have their origin in snowfields and glaciers in Himalayas. More than 70 percent of India's territory drains into Bay of Bengal through Ganges-Brahmaputra river system and several large and small peninsular rivers. Most of India's Peninsular States do not have share of Himalayan rivers as Himalayan rivers are majorly concentrated in northern plains. Significant part of area draining into Arabian sea, accounting for about 20 percent of the total, lie in Indus drainage basin found in north-western India. Himalayan drainage can be studied under the following categories as shown in Fig. 8.2.

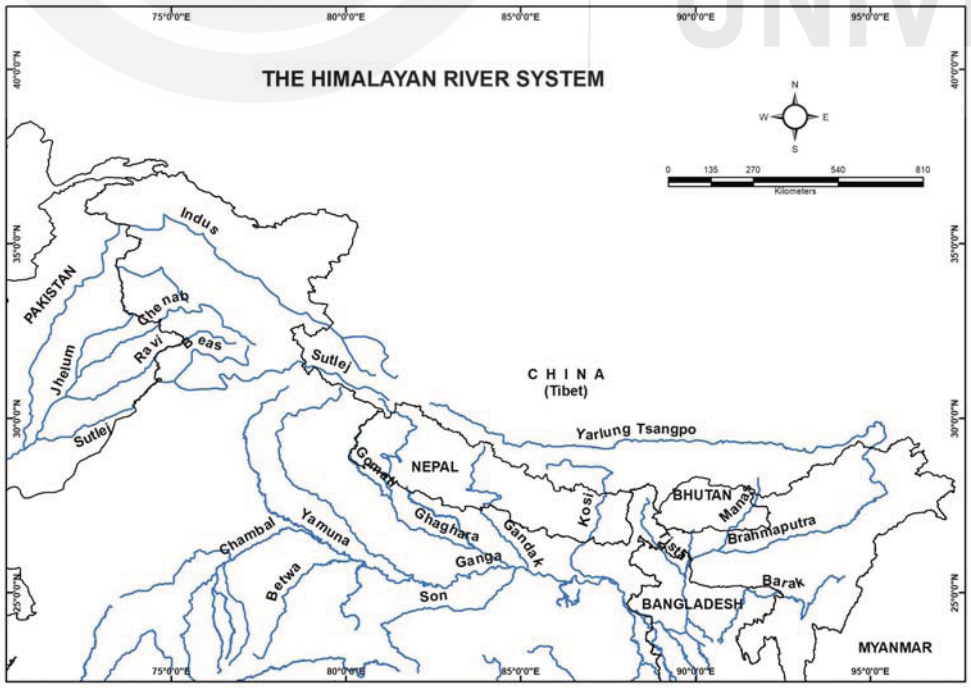

Fig. 8.2: The Himalayan River Systems.

(Source: Adapted from Physical Map of India, Survey of India, SOI (2019), Second Edition)

a) Indus River System

Indus river rises near Lake Mansarovar from glaciers of Kailash range in Western Tibet at an elevation of about 5182 metres. It flows for a distance of about 257 kilometres in Northwest direction in trans-Himalaya region. It then enters India at an elevation of 4206 metres and continues to flow in same northwest direction between Ladakh range and Zanskar range. It is joined by Zanskar and Hanle rivers in its course. Shyok, Gilgit, Dras, Shiger, and Hunza are other important tributaries of Indus which join it in higher areas. After flowing for 480 kilometres, it takes a southerly turn and reaches Attock. It is then joined by Kabul river system. About 800 kilometres before reaching the sea, it receives water from Panchnad (tributaries of five rivers) - Jhelum, Chenab, Ravi, Beas, and Satluj. Indus river from its source of origin to the mouth is about 2880 kilometres long, out of which 709 kilometres is in India.

b) Ganga River System

Ganga river system comprises of river Ganga and its tributaries. Ganga river system covers a very large area in India. Ganga basin in India accounts for 8,61,044 square kilometres which is about 26.3 percent of the total geographical area of the country. Ganga basin is spread over the states of Uttarakhand, Uttar Pradesh, Madhya Pradesh, Chattisgarh, Bihar, Jharkhand, Rajasthan, West Bengal, Haryana, Himachal Pradesh, and Union Territory of Delhi. It originates as Bhagirathi from Gangotri Glacier in Uttar Kashi district of Uttarakhand at an elevation of about 7010 metres. It is joined by river Alaknanda at Devprayag.

However, Alaknanda itself is joined by several rivers before reaching Devprayag. Rivers like Pindar, Mandakini, Dhauliganga, and Bishenganga rivers add a substantial volume of water into Alaknanda. Combined water of Alaknanda and Bhagirathi flows in the name of Ganga below Devprayag. It then reaches Haridwar after travelling 280 kilometres from its source. It flows in south and southeast direction from here for a distance of about 770 kilometres to reach Allahabad. Here it is joined by river Yamuna which is its main tributary. It flows another 300 kilometres eastward to reach Bihar plains. Near Rajmahal hills, it ceases to be known as Ganga. It bifurcates into Bhagirathi-Hugli in West Bengal and Padma-Meghna in Bangladesh. After flowing 220 kilometres down in Bangladesh, Brahmaputra river joins it at Goalundo and after meeting Maghna 100 kilometres downstream, Ganga enters Bay of Bengal.

Before entering Bay of Bengal, Ganga along with Brahmaputra form the world's largest Delta i.e., Ganga-Brahamputra Delta. Large number of Himalayan rivers join river Ganga in its entire journey. Yamuna, Chambal, Son, Damodar, Ramganga, Ghagra, Kali, Gandak, Burhi Gandak, Kosi and their tributaries contribute to Ganga River System.

c) Brahmaputra River System

Brahmaputra rises from Chemayungdung glacier in Kailash range of Trans-Himalayan region at an elevation of about 5150 metres. Its source is 150 kilometres away from the source of Indus river and just 35 kilometres away from the source of Satluj river. However, Brahmaputra flows in eastward direction while Indus and Satluj have westward flow. With total length of 3969

kilometres, Brahmaputra is among the longest rivers of the world. It passes through Tibet (China), India and Bangladesh. It is known as river Tsangpo in Tibet. It flows for a distance of about 1800 kilometres in Southern Tibet. It is joined by several tributaries in Tibet. Raga Tsangpo river joins Tsangpo in North. The river Ngangchu flows through Gyantse region in the South and joins the main river Zhikatse. Towards the end of its journey in Tibet, it turns Northeast and North direction and then traverses in a succession of rapids between the mountains of Gyala and Namcha Barwa. It further turns to south and southwest and cuts through eastern Himalayas making Dihang gorge in mountains near Sadiya in Assam. Here it first flows as Siong river and later as Dihang river. From Sadiya, it flows as Brahmaputra in Assam valley for a distance of about 720 kilometres.

Several tributaries merge with Brahmaputra in Assam valley. Subansiri, Kameng, Belsiri, Dhansiri, Nyera Ama, Manas, Mora Manas, Champaman, Gangadhar, Raidak, Dharla and Tista join Brahamaputra as its tributaries. River Tista was initially tributary of Ganga, however after the flood of 1787, it got diverted towards Brahmaputra. Brahamputra forms many islands in Assam, of which Majuli is most renowned. Brahmaputra floods Assam every year during monsoon season. Flowing around Garo hills, Brahmaputra enters Bangladesh near Dhubri. It flows as Jamuna and joins Ganga. United rivers of Ganga and Jamuna flow further as Padma river.

The river systems can also be studied as follows:

Drainage into Bay of Bengal

Ganges and Brahmaputra rivers, together with their tributaries, drain about one-third area of India. Ganges (Ganga) considered sacred by the country's Hindu population is about 2,510 kilometres long.

It has numerous headstreams that are fed by run-off and meltwater from Himalayan glaciers. Main headwater stream, Bhagirathi river, originates from Gangotri glacier.

Ganges has long course before it finally drains into Bay of Bengal. The river passes through several States and many religious places like Haridwar, Rishikesh and Prayagraj etc., and is joined by several tributaries before reaching the sea.

Major tributaries from west to east are Ghaghara, Gandak, and Kosi, all of these emerge from Himalayas and join Ganges from the north, while Yamuna and Son are two important tributaries joining from the south. Yamuna also has Himalayan source (Yamunotri glacier) and flows roughly parallel to Ganges throughout its course and is joined by several tributaries including Chambal, Betwa and Ken which originate in India's peninsula. Of the northern tributaries of Ganges, Kosi is India's most-destructive river (referred to as the "Sorrow of Bihar"). Because of its large catchment in Himalayas of Nepal and its gentle gradient once it reaches the plain, Kosi is unable to retain large volume of water, so it frequently causes floods and changes its course.

Seasonal flow of Ganges and other rivers fed by meltwaters from Himalayas vary considerably but less than those of exclusively rain-fed peninsular rivers.

That consistency of flow enhances their suitability for irrigation and for navigation where diversion of water for irrigation is not much.

Although, total length of Brahmaputra river is around 3,969 kilometres, exceeding that of Ganges. However, only 725 kilometres of its course lies within India. Brahmaputra, like Indus river, has its origin in trans-Himalayan zone southeast of Mansarovar (Mapam) lake in Tibet Autonomous Region of China. The river runs east across Tibet for more than half of its total length before cutting through Himalayas and entering India at northern border of Arunachal Pradesh state. It then flows south and west through the state of Assam and goes south into Bangladesh, where it forms vast Ganges-Brahmaputra delta. Narrow Brahmaputra basin in Assam is prone to flooding because of its large catchment areas, parts of which receives very heavy precipitation.

Drainage into Arabian Sea

Northwestern part of India has Indus drainage basin. Indus basin, India shares with China, Afghanistan, and Pakistan. Indus river and its longest tributary Sutlej rise in trans-Himalayan area of Tibet.

Indus river initially flows towards northwest between towering Ladakh and Zanskar mountain ranges in the Union Territory of Ladakh before entering Pakistan-occupied portion of Kashmir. It then flows generally southwest through Pakistan, until it reaches Arabian sea. Sutlej river also flows southwest from its source and takes turn towards south to enter India from the border of Himachal Pradesh state. From there, it travels west into the Indian state of Punjab and eventually enters Pakistan, where it joins Indus river.

Between Indus and Sutlej rivers lie several other tributaries. Jhelum river is northernmost of these rivers. It flows out of Pir Panjal range into Vale of Kashmir and thence via Baramula Gorge goes to Pakistan. Three other rivers namely Chenab, Ravi, and Beas originate from Himalayas within the state of Himachal Pradesh. Chenab travels across Jammu and Kashmir before flowing into Pakistan; Ravi forms a part of southern boundary between Jammu and Kashmir and Himachal Pradesh and thereafter a short stretch of India-Pakistan border before entering Pakistan; and Beas flows entirely within India, joining Sutlej in the Indian state of Punjab. The area through which the five Indus tributaries flow has traditionally been called Punjab (also known as the land of five rivers) of which only its eastern part is in India. These rivers have immensely helped to boost Punjab's agricultural prosperity through canal irrigation.

8.3.4 Climate

Climate especially temperature of Himalayan mountain region is greatly affected by its altitude. With increasing altitude, temperature tends to decline. Amount of rainfall decreases from east to west from more than 200 centimetres in the east to around 150 centimetres in the centre and 125 centimetres in the west. Besides this, the western part of the Himalayan region receives winter rainfall due to western disturbances. Average annual rainfall on southern slopes varies from 150-160 centimetres at Shimla, Himachal Pradesh and

Mussoorie in Uttarakhand. Similarly, area around Sikkim, Darjeeling hills, and Eastern Himalayas receives average annual precipitation exceeding 250 centimetres. Local relief and location affect climatic variations in different parts of Himalayas. Eastern Himalayas which are situated at lower altitude than western Himalayas are relatively warmer. Average minimum temperature for May in Darjeeling lying at an elevation of 1950 metres is about 11 Degree Celsius. Whereas in the same month, at an elevation of above 6000 metres, temperature drops to minus 22 Degree Celsius around Mount Everest peak.

Himalayas play significant role in affecting large system of air and water circulation, thereby, influencing overall climatic conditions in Indian sub-continent. Its location is in the extreme north and by its majestic height, Himalayan ranges obstruct passage of cold continental air blowing from north into India during winter season. It also obstructs south-west monsoon (rain-bearing) winds in summer to cross across it, thereby, resulting in precipitation on northern plains of India.

8.3.5 Vegetation

Vegetation in Himalayas can be generally divided into several elevation zones. **Mixed evergreen-deciduous forests** dominate foothill areas up to height of 1,500 metres. Above it lies **sub-tropical pine forests** followed by **Himalayan moist-temperate forest** of oak, fir, deodar, and spruce. Highest tree zone, consisting of alpine shrubs, is found up to an elevation of about 4,500 metres. Rhododendrons are very common at an altitude of about 3,700 metres, well known for their medicinal properties. Occasional junipers and alpine meadows are also common at same altitude. However, there are no clear-cut vegetation zones.

Hence, Himalayan vegetation can be broadly classified into four major types-tropical, sub-tropical, temperate, and Alpine. Each vegetation type has its unique climatic characteristics. Tropical evergreen is confined in the foothills of Eastern and Central Himalayas. With decreasing precipitation and increasing elevation in the west, rainforest gives way to tropical deciduous forest where valuable timber like Sal tree is more dominant. Further west, steppe vegetation and sub-tropical semi-desert type vegetation occur successively. The alpine zone begins above tree line between the elevations of 3200-3600 metres and extends upto 4500 metres. Mosses and lichens grow in shaded areas at low levels in the alpine zone. Flowering plants are also found in alpine zone.

Himalayan vegetation can be broadly classified into four types as tropical, subtropical, temperate, and alpine. Each of these types is found in a zone determined mainly by elevation and precipitation. Local differences in relief and climate, as well as exposure to sunlight and wind, cause considerable variation in the species present within each zone. Tropical evergreen rainforest is confined to humid foothills of eastern and central Himalayas. Evergreen dipterocarpaceae groups of timber-and resin-producing trees are common; their different species grow on different soils and on hill slopes of varying steepness. Ceylon ironwood (Mesua ferrea) is found on porous soils at elevations between 600 and 2,400 feet (180 and 720 metres); bamboos grow on steep slopes; oaks (genus Quercus) and Indian horse chestnuts (Aesculus indica) grow on the lithosol (shallow soils consisting of imperfectly

weathered rock fragments), covering sandstones from Arunachal Pradesh westward to central Nepal at elevations from 3,600 to 5,700 feet (1,100 to 1,700 metres). Alder trees (genus Alnus) are found along water courses on steeper slopes. At higher elevations, those species give way to mountain forests in which the typical evergreen is Himalayan screw pine (Pandanus furcatus). Besides those trees, some 4,000 species of flowering plants, of which 20 are palms, are estimated to occur in eastern Himalayas.

With decreasing precipitation and increasing elevation westward, the rainforest give way to tropical deciduous forest, where valuable timber tree Sal (Shorea robusta) is dominant species. Wet Sal forest thrive on high plateau at elevations of about 3,000 feet (900 metres), while dry Sal forest prevail higher up, at 4,500 feet (1,400 metres).

Further west, steppe forest (i.e., expanse of grassland dotted with trees), steppe, subtropical thorn steppe, and subtropical semidesert vegetation occur successively. Temperate mixed forests extend from about 4,500 feet to roughly 11,000 feet (1,400 to 3,400 metres) and contain conifers and broad-leaved temperate trees. Evergreen forest of oak and conifers have their westernmost outpost on hills above Murree, northwest of Rawalpindi, in Pakistan; those forests are typical of Lesser Himalayas, being conspicuous on outer slopes of Pir Panjal, in Jammu and Kashmir union territory. Chir pine (Pinus roxburghii) is dominant species at elevations from 2,700 to 5,400 feet (800 to 1,600 metres).

In the inner valleys that species may occur even upto 6,300 feet (1,900 metres). Deodar cedar (Cedrus deodara), a highly valued endemic species, grows mainly in western part of the range. Stands of that species occur between 6,300 and 9,000 feet (1,900 and 2,700 metres) and tend to grow at still higher elevations in the upper valleys of Sutlej and Ganges rivers. Of the other conifers, blue pine (Pinus wallichiana) and morinda spruce (Picea smithiana) appear between about 7,300 and 10,000 feet (2,200 and 3,000 metres).

The alpine zone begins above tree line, between elevations of 10,500 and 11,700 feet (3,200 and 3,600 metres), and extends upto about 13,700 feet (4,200 metres) in western Himalayas and 14,600 feet (4,500 metres) in eastern Himalayas. In that zone, all wet and moist alpine vegetation can be found. Juniper (genus Juniperus) is widespread, especially on sunny sites, steep and rocky slopes and drier areas. Rhododendron occurs everywhere but is more abundant in wetter parts of eastern Himalayas, where it grows in all sizes from trees to low shrubs. Mosses and lichens grow in shaded areas at lower levels in the alpine zone where humidity is high. Flowering plants are found at higher elevations.

The vegetation in the Himalayas can be understood from its altitudinal distribution as shown below:

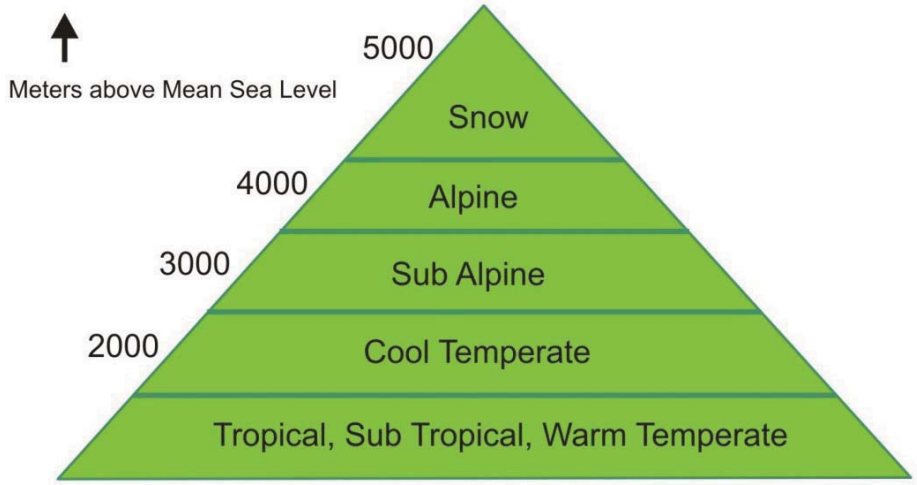

Fig. 8.3: Vegetation.
(Source: Adapted and Redrawn from https://www.thethirdpole.net/en/climate/how-altitude-will-decide-himalayan-communities-survival)

8.3.6 Soils

India has a wide variety of soils owing to its large geographic area and different episodes of crustal changes in geological periods. Soil formation and types were affected by different natural and environmental processes. Type of soil is determined by numerous factors including climate, relief, elevation, and drainage, as well as by underlying rock material. Soil can broadly be divided into two groups: In-situ (found at their places of origin) soils and Ex-situ (transported) soils. Among in-situ soils are red-to-yellow and black soils (regur). Ex-situ soil gets transported from its place of formation. Different agents and erosion followed by transportation contributes to the formation of Mountain soil. It also gets affected by accumulation of organic matter derived from vegetation. Mountain soil is generally shallow in depth and immature. This type of soil is rich in humus but has poor lime, potash, and phosphorus content. It is usually sandy and has gravel. It is mainly found in Himalayan areas of Sikkim, Arunachal Pradesh and Assam.

Depending on the climate, mountain soil can be divided into two broad groups: (1) Loamy Podzols, and (2) High Altitude Soils. Mid-altitudinal zone in Himalayas has Podzols. This soil is acidic with low humus and is found in Assam, Darjeeling, Kashmir, Uttarakhand and Himachal Pradesh. Maize, barley, wheat, and temperate fruits are grown in this soil in Himalayan region. Deposition makes it Ex-situ mostly. Alluvial soil is third most common type.

Most important characteristic of Himalayan soil is its massive water-holding capacity which ensures a consistent supply of water for the growth of vegetation throughout the year. Presence of proteobacteria in high-altitude soil of Himalayas releases traces of carbon, nitrogen and sulphur into soil which are consumed by plants and gets converted into organic form that supports different varieties of crops.

8.3.7 Physical Resource Base

Himalayas are rich in minerals, although, exploitation is restricted to more accessible areas. Kashmir region has some concentration of minerals.

Sapphires are found in Zanskar range, and alluvial gold is recovered in nearby bed of Indus River. Ladakh possesses borax and sulphur deposits. Coal seams are found in Jammu hills. Bauxite also occurs in Kashmir. Nepal, Bhutan, and Sikkim have extensive deposits of coal, mica, gypsum and graphite and ores of iron, copper and lead.

Himalayan rivers have tremendous potential for hydroelectric generation. That potential was first harnessed intensively by India beginning in 1950s. A giant multipurpose project is located at Bhakra-Nangal on Sutlej river in Outer Himalayas; its reservoir was completed in 1963 and has storage capacity of some 348 billion cubic feet (10 billion cubic metres) of water and total installed generating capacity of 1,050 megawatts. Other Himalayan rivers including Kosi, Gandak (Narayani) and Jaldhaka are harnessed by India, which also supply electric power to Nepal and Bhutan. Subsequent major projects in India included Nathpa Jhakri dam on Sutlej in Himachal Pradesh and just downstream from that site, Rampur station, which became operational in 2014. Beside these, several dams have been constructed over river Teesta in different stages in Sikkim Himalaya. Nepal has also constructed hydropower projects in Himalayas, as has China, which completed the Zangmu station on Yarlung Zangbo (Brahmaputra) river in Tibet in 2015.

SAQ I

a) Explain three major divisions of the Himalayas.

b) Write a note on the major river system that drains into the Arabian sea and the Bay of Bengal.

c) Himalayan mountains have a large potential for physical resources base. Explain.

8.4 HIMALAYA AND ASSOCIATED MOUNTAIN RANGES: THE CULTURAL SETTING

Himalayas are spread across five countries - India, Nepal, Bhutan, China, and Pakistan. Four noticeably different cultural groups exist in the Himalayas- Buddhists, Hindus, Islam followers and Animistic groups.

Hindus practice their religion and pray to their specific deities. They personified the Himalayas as Himavath, father of goddess Parvati. Himalayas are also considered and known to be the father of the river Ganges. Lord Shiva is also believed to live on Mountain Kailash, considered a sacred peak by Hindus. There are several temples and pilgrimage places in the Himalayan mountain ranges in India. Hindus offer prayers and visit pilgrimage places located in different Himalayan States. Uttarakhand, Nepal, Sikkim, Himachal Pradesh, and Assam have the majority of Hindu population. Muslim populations are, however, sparsely distributed mostly confined in Jammu and Kashmir, Assam, Sikkim and Darjeeling hills.

Buddhists also attach great importance to the mountains of the Himalayas. Some worship mountains as their life-giver, preserver, and protector. Within Buddhism, there is a hierarchical order, with highly esteemed "lamas" occupying the positions of greatest influence. Gompas found in higher places of the Himalayas, especially in trans-Himalayan areas are sacred monasteries of Buddhists. People in these areas are followers of Buddhism. Himalayan mountains are also home to Tibetans, who mostly follow Buddhism as their religion. Tibet, Bhutan, Nepal, Ladakh, Spiti, Sikkim, Darjeeling, and Arunachal Pradesh have a considerable Buddhist population.

8.4.1 Population

India is a diverse multi-ethnic country and is home to thousands of small ethnic and tribal groups. Process of migration and inter-marriages within and among different ethnic groups has led to complexities of different forms. Great urban culture of the Indus civilisation, a society of Indus river valley that is thought to have been Dravidian-speaking, thrived from roughly 2500 to 1700 BCE. Aryan civilisation - dominated by peoples with linguistic affinities to peoples in Iran and Europe - came to occupy north-westward and then north-central India over the period from roughly 2000 to 1500 BCE and subsequently, spread south-westward and eastward at the expense of other indigenous groups.

Despite the emergence of caste restrictions, that process of inter-marriage between groups continued despite considerable opposition from people whose own distinctive cultures had also evolved in early historical times. Among the documented invasions that added significantly to the Indian ethnic mix are those of Persians, Scythians, Arabs, Mongols, Turks and Afghans. Last and politically most successful of great invasions mainly from Europe vastly altered Indian culture but had relatively little impact on India’s ethnic composition.

Broadly speaking, people of north-central and north-western India tend to have ethnic affinities with European and Indo-European people from southern Europe, the Caucasus region, and Southwest and Central Asia. In north-eastern India, West Bengal (to a lesser degree), the higher reaches of western Himalayan region and Ladakh, much of population closely resembles people to the north and east - notably Tibetans and Burmese.

Population of Himalayas has grown by 250 percent, from 19.9 million to 52.8 million in the last fifty years (1961-2011). If the population keeps growing at the same rate (3.3 percent annually) as during the last fifty years (1961-2011), the number of people will exceed 260 million in 2061. This may led to problems. Fortunately, recent decades has shown growth rate to be slowing down. For example, average annual growth rate of population in Nepal was 2.25 percent between 1999-2001 which came down to 1.35 percent between 2001-2011. Nevertheless, population of Himalayas landscape increased by more than 32 million people in the last 50 years. Table 8.1 shows overall demographic profile of Himalayan regions.

Table: 8.1: Demographic Profile of Himalayan Regions

Region	Area (Km^2)	Population 1911	Population 1961	Population 2011	Percent Growth 1911-1961	Percent Growth 1961-2011	Population Density 1911	Population Density 1961	Population Density 2011
Kashmir Himalaya	222,236	2,292,535	3,560,976	12,541,302	53.33	252.19	10.32	16.02	56.43
Punjab Himalaya	64,017	3,393,237	5,120,952	13,050,920	50.92	154.85	53.01	79.99	203.87
Kumaun Himalaya	41,762	1,575,228	2,601,674	6,045,035	65.16	132.35	37.72	62.30	144.75
Nepal Himalaya	113,161	Not available	5,991,297	13,175,799	----	119.92	-----	52.94	116.43
Sikkim Himalaya	7,096	87,920	162,189	610,577	84.47	276.46	12.39	22.86	86.05
Darjeeling Himalaya	6,193	943,121	1,983,932	5,719,669	110.36	188.30	152.29	320.35	923.57
Bhutan Himalaya	38,394	200,000	232,000	738,267	16.00	218.22	5.21	6.04	19.23
Arunachal Himalaya	55,101	Not available	240,917	894,549	------	271.31	-----	4.37	16.32
Total Himalaya	547,960	8,492,041*	19,893,937	52,776,118	60.88*	165.29	22.27*	36.31	96.31

(Source: Census of India 1911, 1961, 2011; Central Bureau of Statistics, Nepal 1961, 2011; Royal Government of Bhutan 1911, 1961, 2011 in Michael Apollo (2017) The Population of Himalayan regions by the numbers: Past, present and future)

Table: 8.2: Population Distribution in Indian Himalayan Region

India/State	Geographical Area (Km^2)	Human Population			Percent Decadal Growth	
		Male	Female	Total	1981-1991	1991-2001
India	**3,287,263**	**532,223090**	**496,514,346**	**1,028,737,436**	**23.87**	**21.54**
Jammu and Kashmir	222,236	5,360,926	4,782,774	10,143,700	30.89	29.43
Himachal Pradesh	55,673	3,087,940	2,989,960	6,077,900	20.79	17.54
Uttarakhand	53,483	4,325,924	4,163,425	8,489,349	23.13	20.41
Sikkim	7,096	288,484	252,367	540,851	28.47	33.06
Arunachal Pradesh	83,743	579,941	518,027	1,097,968	36.83	27.00
Nagaland	16,579	1,047,141	942,895	1,990,036	56.08	64.53
Manipur	22,327	1,161,952	1,31,944	2,293,896	29.29	24.86
Mizoram	21,081	459,109	429,464	888,573	39.70	28.82
Meghalaya	22,429	1,176,087	1,142,735	2,318,822	32.86	30.65
Tripura	10,486	1,642,225	1,556,978	3,199,203	34.30	16.03
Assam	78,438	13,777,037	12,878,491	26,655,528	24.24	18,92
Assam Hills	15,322	NA		3,313,896	NA	NA
WB Hills	3,149	NA		1,605,900	NA	NA

(Source: Statistics of Indian Himalayan Region, 2010 (Compiled by GB Pant Institute of Himalayan Environment and Development); Compendium of Statistics for the States of Indian Himalayan Region, 2010)

Table 8.2 reflects that Sikkim registered highest decadal population growth rate during 1991-2001 leaving aside some other North-Eastern states which are

technically not part of Himalayas. Perhaps this can be attributed to migration combined with natural growth. Sikkim being a very small Indian state in terms of population where even a small increase in population results in higher percentage growth. Similarly, among the Purvanchal states, Nagaland have registered quite high decadal population growth rate. In-migration is also understood as one of the prominent factors of this dramatic increase for Nagaland.

Table 8.3: Demographic Characteristics

India/State	Percent contribution to the total Indian Himalayan Region population	Decadal Growth Rate	Annual Average Exponential Growth Rate	Population Density	Sex Ratio	Literacy Rate (+ 7yr)
		1991-2001	1961-2001	Per Sq. Km.	Females/1000 males	(%)
Jammu and Kashmir	25.41 (0.98)	30.46	2.6	99	900	54.46
Himachal Pradesh	15.34 (0.59)	17.53	1.93	109	970	75.91
Uttarakhand	21.40 (0.83)	20.27	2.16	159	964	72.28
Sikkim	1.36 (0.05)	32.98	3.01	76	875	69.68
Arunachal Pradesh	2.75 (0.11)	26.21	2.94	13	901	54.74
Nagaland	5.82 (0.22)	29.94	2.74	103	975	63.31
Manipur	2.25 (0.09)	29.19	3.02	42	938	88.49
Mizoram	6.03 (0.23)	30.02	2.8	107	978	68.87
Nagaland	5.02 (0.19)	64.41	4.21	120	909	67.11
Tripura	8.05 (0.31)	15.74	2.57	304	950	73.66
Assam Hills	2.52 (0.10)	22.74	2.56	65	915	60.68
West Bengal; Hills	4.05 (0.16)	23.54	2.38	510	943	72.87

(Source: Compendium of Statistics for the states of Indian Himalayan Region, 2010. G.B. Pant Institute of Himalayan Environment and Development, Almora)

Literacy and sex ratio are important components of population. Higher literacy and equal male-female ratio in many cases signify positive aspects of population. As evident from Table 8.3, Himachal Pradesh and Uttarakhand have higher literacy of 75 percent to 72 percent respectively among Himalayan states. Whereas Arunachal Pradesh and Jammu and Kashmir have literacy rates of around 54 percent. This can be attributed to the facts that these two provinces are geographically bigger, spatially remoter with more undulating topography, large forested area and tribal population. These factors make accessibility to educational infrastructure difficult.

Moreover, these states have not seen much of the role of Christian missionaries as is seen in states like Mizoram. Literacy appears to have positively influenced sex ratio among the Himalayan and Purvanchal states. Himachal Pradesh and Uttarakhand have higher literacy as compared to other Himalayan states like Arunachal Pradesh and Jammu and Kashmir. Hence, sex ratio of the later two states is relatively lower to the tune of 901 and 900.

Of the four principal language families in Indian subcontinent; Indo-European, Tibeto-Burman, Austroasiatic and Dravidian the first two are well represented in Himalayas. People speaking languages from both families are mixed in varying

proportions in different areas since ancient times. Their distribution is the result of long history of penetration by Central Asian and Iranian groups from the west, Indian people from the south and east Asian peoples from the east and north. The penetration in lower Himalayas was instrumental to migrations into and through river-plain passageways of South Asia.

Generally speaking, the Great Himalayas and the trans-Himalayas are inhabited by Tibetans speaking people which belongs to Tibeto-Burman languages while lower Himalayas are home of Indo-European language speakers. Among the latter are Kashmiri people of the Vale of Kashmir and Gaddis and Gujars who live in Lesser Himalayas. Traditionally, Gaddis are hill people; they possess large flocks of sheep and goats and go down from their snowy abode in lower areas of higher Himalayas in winter, returning again to higher pastures in June. Gujars are traditionally migrating pastoral people who live off their herds of sheep, goats and cattle for which they use pastures at higher elevations.

Changpas, Ladakhi, Balti and Dard people live to the north of Great Himalayan range in Kashmir Himalayas. Dards speak Indo-European language, while the others are Tibeto-Burman speakers. Changpas traditionally lead nomadic pastoral life in upper Indus basin. Ladakhi have settled on terraces and alluvial fans that flank Indus and its tributaries in Trans-Himalayan Ladakh region. Baltis have spread farther down the Indus valley of Trans-Himalayan region and follow Islam.

Other Indo-European speakers are Kanets in Himachal Pradesh and people of Uttarakhand. Most people in districts of Kinnaur and Lahaul-Spiti of Himachal Pradesh speak Tibeto-Burman languages.

Indo-European languages constitute majority of the population, although large groups of Tibeto-Burman speakers are found throughout the country. They include Newar, Tamang, Gurung, Magar, Sherpa and some other people related to the Bhutia, and the Kirat.

Sikkim region now a state of India and the kingdom of Bhutan have been safety valves for the absorption of the excess population of eastern Nepal for some 200 years. More Sherpa now live in Darjeeling area than in Mount Everest homeland. At present, Paharis constitute majority who come from Nepal in both Sikkim and Bhutan. Thus, people of Sikkim belong to three distinct ethnic groups - the Lepcha, the Bhutia, and the Pahari. Generally speaking, Nepalese and Lepcha live in western Bhutan and Bhutia of Tibetan origin in eastern Bhutan.

Arunachal Pradesh is the homeland of several tribal groups - Abor or Adi, Aka, Apa Tani, Dafla, Khampti, Khowa, Mishmi, Momba, Miri and Singpho. Linguistically, they speak Tibeto-Burman. Each group has its homeland tucked in a distinct river valley, and all traditionally have been practicing shifting cultivation which means that they shift to different tract of land after cultivating land for a few years. So that the original land is left fallow for many years to regain its fertility.

8.4.2 Settlement

Only tiny fraction of India's surface area is uninhabited. More than half of it is cultivated, with little left fallow in any given year. Some of the area has been

classified as forest. Roughly one-fifth of total is used for grazing, gathering firewood and other forest products and for commercial forestry. It is used for shifting cultivation (often in defiance of the law) and hunting in tribal areas. Land too dry for growing crops and without irrigation is largely used for grazing. Higher elevations of Himalayas have only places with substantial continuous areas not in use by humans.

Many urban settlements in Himalayan region had their origin in colonial era. Some places were developed as resort towns in Himalayas which later got agglomerated into new towns. There are many regional variants from simple pattern of agglomerated-villages.

Many settlements are on hillocks or mounds and their size is generally small. Nucleated settlements may be observed in hilly and undulating tracts of Himachal Pradesh, Kandi lands of Jammu and Kashmir, and Lesser Himalayas and Shiwaliks in Uttarakhand.

Understanding settlements involves analysing various aspects such as site, situation, pattern and morphology. These factors can vary widely in the Indian Himalayas due to diverse topography, climate and socio-economic conditions. Site refers to physical characteristics of location in terms of elevation, water sources and natural features. Situation of settlements describes broader geographical and economic context including accessibility, strategic importance, and the role in regional economy. Similarly, pattern indicates the spatial arrangement of settlements, which can vary from clustered to linear to dispersed patterns based on geographical constraints and historical factors. Settlement morphology pertains to physical form and layout of settlement including traditional and modern architecture, street patterns and land use. Here's an overview of some selected urban settlements in terms of their characteristics in Himalayan region as shown in Table 8.4 below:

Table 8.4: Settlements Characteristics

Aspects	Descriptions
1. Shimla, Himachal Pradesh	
Site	Located on a ridge at an elevation of 2,200 metres, with access to local springs.
Situation	Key administrative and tourism hub, historically important during British rule.
Pattern	Clustered around the ridge with linear development along the main road.
Morphology	Compact layout with narrow streets, colonial-era buildings, modern extensions.
2. Dharamshala, Himachal Pradesh	
Site	Located at an elevation of 1,457 metres on a series of terraces.
Situation	Major base for tourism, residence in exile of His Holiness Dalai Lama (spiritual leader of Tibetan people), and administrative hub.
Pattern	Clustered around the main road with scattered settlements in the surrounding areas.
Morphology	Mix of traditional and modern buildings with a focus on tourism infrastructure.
3. Leh, Ladakh	
Site	Located at an altitude of 3,500 metres in high-altitude cold desert valley.
Situation	Major tourist destination, administrative centre, and key hub for military activities.
Pattern	Scattered pattern due to topographical constraints, with settlements clustered around key infrastructural amenities.

Morphology	Traditional Ladakhi architecture with flat roofs, modern developments, and adaptation to arid conditions.
4. Nainital, Uttarakhand	
Site	Located at an elevation of 2,084 metres around the shores of Naini lake.
Situation	Popular hill station with a focus on tourism and seasonal influx of visitors.
Pattern	Clustered around the lake with a radial pattern extending outward.
Morphology	Compact layout with colonial-style architecture, modern tourist facilities, and lake-centered development.
5. Gangtok, Sikkim	
Site	Situated at an elevation of 1,650 metres on a ridge with view of Kanchenjunga peak of Great Himalayan range.
Situation	Administrative centre with strategic access to Bhutan and Tibet, important for tourism.
Pattern	Linear development along the ridge with steep slopes on either side.
Morphology	Terraced development featuring traditional Sikkimese architecture (which is more influenced by Tibetan architecture) and modern infrastructural amenities.
6. Itanagar, Arunachal Pradesh	
Site	Located at an altitude of around 440 metres in a valley with nearby hills providing natural protection.
Situation	State capital and administrative centre with strategic significance.
Pattern	Linear and clustered pattern around major roads and administrative buildings.
Morphology	Modern layout with governmental and residential buildings, with emerging infrastructural amenities.

8.4.3 Economy

Economic conditions in Himalayas partly depend on limited resources available in different parts of this vast region of varied ecological zones. Principal activity is animal husbandry, but forestry, trade, and tourism are also important. Himalayas abound in economic resources. Those include pockets of rich arable land, extensive grasslands and forest, workable mineral deposits, easy-to-harness waterpower, and great natural beauty. Most productive arable land in western Himalayas is in Vale of Kashmir, Kangra valley, Sutlej river basin, and on terraces flanking Ganges and Yamuna rivers in Uttarakhand. These areas produce rice, corn (maize), wheat and millets. In central Himalayas in Nepal, two-third of arable land is in foothills and in adjacent plains. This land is used for rice production. The area also produces corn, wheat and potatoes.

Most of fruit orchards of Himalayas lie in Vale of Kashmir and the Kullu valley of Himachal Pradesh. Temperate fruits such as apples, peaches, pears, and cherries - for which there is a great demand in cities of India, are grown extensively. Walnut and almond are grown on hills surrounding Vale of Kashmir. Bhutan also has fruit orchards and exports oranges to India.

Tea is grown in plantations mainly on hills and foothill plains in Darjeeling district and other foothill areas of eastern Himalayas. Plantations also produce limited amount of tea in Kangra valley of Himachal Pradesh. Plantations of spice mainly of cardamom are found in Sikkim, Bhutan and Darjeeling hills. Medicinal herbs are grown on plantations in some areas of Uttarakhand.

Transhumance (the seasonal migration of livestock) is widely practiced in Himalayan pastures. Sheep, goats, and yaks are raised on available rough

grazing lands. They graze on pastures at higher elevations during summer but migrate to lower mountain valleys in winter.

Tourism has become an increasingly important source of income and employment in parts of Himalayas, especially Nepal. In addition to sightseers, there has been a dramatic rise in the number of foreign trekkers in lower mountains, as well as among mountaineers desirous of climbing Mount Everest and other notable higher mountain peaks. This has resulted in increased traffic and tourists' heavy consumption of the region's limited resources.

Land use and landcover data can help in understanding the overall pattern of economic activities and the availability of land for different activities. Land-use pattern of Indian Himalayan region can be understood from Table 8.5. It is evident from the Table that Himachal Pradesh has highest cropping intensity followed by Uttarakhand along with Jammu and Kashmir. Cropping intensity refers to number of crop cycles or harvests that occur on a particular piece of agricultural land in a year. It is a measure of how efficiently land is utilised for growing crops and is an important indicator of agricultural productivity. Higher cropping intensity often indicates more efficient land use and greater agricultural output. As opposed to Himachal Pradesh and Uttarakhand; Manipur, Mizorum, Tripura and Sikkim have lower cropping intensity among Himalayan and Purvanchal states. Agriculturally, Sikkim has the least area sown more than once in a year.

Fallow land other than current fallow is quite high in Sikkim as compared to Jammu and Kashmir, Himachal Pradesh, Uttarakhand and Arunachal Pradesh. This reflects that higher proportions of farmers are not tilling their land in Sikkim as compared to rest of the Himalayan states. Similarly, Meghalaya also has noticeably higher old fallow land among the Purvanchal states.

Table 8.5: Details of Landuse in Himalayan Regions (in thousand hectares)

State	Fallow Lands			Net sown area	Total cropped area	Area sown more than once	Cropping Intensity	Agri. Land cultivable land culturable land	Cultivated land	Un-cultivable/ Un-culturable land	Un-cultivated land
	Fallows lands other than current fallows (old fallow lands)	Current fallows	Total								
Jammu and Kashmir	12	73	85	752	1090	338	144.9	1050	826	2731	2955
Himachal Pradesh	17	56	73	541	940	399	173.9	804	597	3740	3988
Uttarakhand	30	5	35	112	123	11	109.8	155	117	573	611
Sikkim	68	42	110	767	1266	499	165.1	1512	808	4158	4862
Arunachal Pradesh	64	23	87	200	267	67	133.4	361	223	5186	5324
Nagaland	0	0	0	238	238		100.0	245	239	1721	1728
Manipur	169	66	235	212	258	46	121.9	1058	278	1169	1949
Mizoram	82	24	106	97	97		100.0	218	121	1733	1831
Nagaland	76	82	158	309	387	78	125.2	644	391	938	1191
Tripura	1	1	2	280	299	19	106.6	310	281	740	768
Assam	66	99	164	2774	3731	957	134.5	3224	2873	4626	4977

(Source: 2006-07 Ministry of Agriculture, Govt. of India in the Compendium of Statistics for the States of Indian Himalayan Region, 2010. G.B. Pant Institute of Himalayan Environment and Development, Almora)

Table 8.6: Foodgrains Yield/Productions (in Kg/hectare)

India/State	Foodgrains			Crops		Total Pulses
	Kharif	Rabi	Total	Rice	Wheat	
Jammu and Kashmir	1710	1713	1711	2133	1782	508
Himachal Pradesh	2448	1377	1918	1546	1376	1062
Uttarakhand	1633	1969	1785	2052	2050	794
Sikkim	1451	949	1378	1636	1000	928
Arunachal Pradesh	1234	1348	1241	1275	1472	1078
Manipur	2348	-	2297	2446	-	497
Meghalaya	1556	3463	1774	1889	1833	825
Mizoram	263	1286	285	288	-	529
Nagaland	1589	1188	1567	1685	1067	1189
Tripura	2549	2599	2563	2633	1900	691
Assam	1283	1774	1378	1428	1268	558

(Source: Compiled from Ministry of Agriculture, Govt. of India in the Compendium of Statistics for the states of Indian Himalayan Region, 2010. G.B. Pant Institute of Himalayan Environment and Development, Almora)

Data of yield of agricultural crops as shown in Table 8.6 help in understanding contribution of different states of Indian Himalayan region in different season of the year. Himachal Pradesh, Uttarakhand and Jammu and Kashmir are prominent Himalayan states in terms of yield of foodgrain crops followed by Sikkim and Arunachal Pradesh.

8.4.4 Transport and Communication

Since long, trails and footpaths were the only means of communication in the Himalayas. However, those continue to be important, especially in more remote locations. Road transport now has made the Himalayas accessible from both north and south directions. In Nepal, an east-west highway stretches through Tarai lowlands, connecting roads that penetrate many of the country's mountain valleys. The capital, Kathmandu, is connected to Pokhara by a low Himalayan highway and another highway through Kodari Pass gives Nepal access to Tibet.

A highway running from Kathmandu through Hetauda and Birganj to Birauni connects Nepal to Bihar state and the rest of India. To the northwest of Pakistan, the Karakoram Highway links that country with China. Hindustan-Tibet road, which passes through Himachal Pradesh, has been considerably improved; that 300-mile (480 kilometres) highway runs through Shimla, once the summer capital of India, and crosses the Indo-Tibet border near Shipkila pass.

From Manali in Kullu Valley, a highway now crosses not only the Great Himalayas but also the Zanskar range and reaches Leh in the upper Indus valley. Leh is also connected to India via Srinagar in Vale of Kashmir; the road from Srinagar to Leh passes over Zoji-La Pass. Leh-Nubra road passes through, 3559 metres high Khardung-La Pass - the highest motorable pass on the historic caravan trail to Central Asia from India. Many other new roads have been built since the 1950s.

The only direct approach to the Vale of Kashmir from the Indian state of Punjab is by highway from Jammu to Srinagar. It starts from Jammu the

summer capital of Jammu and Kashmir Union Territory and passes through Udhampur, Banihal, and Patni Top etc. It crosses the Pir Panjal range through a tunnel located at Banihal. The old road from Rawalpindi, Pakistan, to Srinagar, lost its importance with the closing of the road at the Line of Control (LOC) between the sectors of Kashmir administered by India and Pakistan.

Only two main railroads, both of narrow gauge, penetrate the Lesser Himalayas from the plains of India: one in the western Himalayas, between Kalka and Shimla and the other in the eastern Himalayas, between Siliguri and Darjeeling. Another narrow-gauge line in Nepal runs for some 30 miles from Raxaul in Bihar state, India, to Amlekhganj in Nepal. Two other short railroads run to the Outer Himalayas - one, the railroad of Kullu valley, from Pathankot to Joginder Nagar and the other from Haridwar to Dehra Dun.

There are two major airstrips in the Himalayas, one at Kathmandu and the other at Srinagar; the airport at Kathmandu is served by international as well as regional flights. Besides those, there are also an increasing number of airstrips of local importance in India and other countries in the Himalayas that normally can accommodate small aircraft. Some of these airports are Bhuntar near Kullu, Shimla, Dehradun, Jammu, and Dharamshala etc. Improvements in both air and ground transportation have facilitated the growth of tourism in the Himalayas prominently in the last few decades and have added problems of social, cultural and environmental nature, thus, creating risk to fragile ecosystems.

SAQ 2

a) Write a note on the cultural setting of people across the Himalayan region.

b) Describe the economy of the Himalayan region.

c) Efficient transport and communication form the backbone of the economy. Taking transport and communication into account, explain their significance in the Himalayan region.

8.5 HIMALAYA AND ASSOCIATED MOUNTAIN RANGES: THE REGIONS

From west to East, the Himalayas have been divided into six regions viz., Kashmir Himalayas, Himachal Himalayas, Kumaun Himalayas, Central and Sikkim Himalayas, Arunachal Himalayas, and Purvanchal Himalayas.

Kashmir Himalayas

Westernmost of the Himalayan mountain range is Kashmir Himalaya. It has the largest number of Glaciers in India. Ladakh region of Kashmir Himalayas is India’s Cold Desert Biosphere Reserve. Kashmir Himalayas has Karewa deposits in Kashmir valley which are made up of silt, clay and sand. These deposits are very important for the agriculture and horticulture sector in Kashmir valley. Karewas are known for saffron cultivation and have orchards of fruits and nuts such as apples, peaches, almonds, and walnuts of high quality. Major physical characteristics of the Kashmir Himalayas are glaciers,

snow-covered peaks, deep valleys, and high altitude mountain passes. Pir-Panjal, Banihal, Zoji-La, Saser-La, Chang-La, and Jara-La etc., are the major mountain passes in these ranges.

Himachal Himalaya is spread in Himachal Pradesh. Rohtang, Bara-Lacha, and Shipki-La are important mountain passes here. Valleys of Kullu, Kangra, Manali, Lahaul and Spiti known for orchards and tourist spots are all parts of Himachal Himalaya.

Kumaun Himalaya is located between the Sutlej and Kali rivers. It is home to some of India's highest peaks i.e., Nanda Devi. Other peaks located in Kumaun Himalaya are Kamet, Trishul, Badrinath, Kedarnath, Dunagiri, and Gangotri, etc. Gangotri and Pindar are important glaciers of the Kumaun Himalaya.

Central and Sikkim Himalaya is located beyond Kali river upto Teesta river. A large part of the Central Himalayas is located in Nepal. Central Himalayas are home to the highest peaks of the Himalayas such as Everest, Kanchenjunga, Makalu, Dhaulagiri and Annapurna. It is characterised by few mountain passes. Two mountain passes namely Nathu La and Jelep-La are most important, as these connect India's Sikkim region with Tibet's autonomous region of China.

Arunachal Himalayas and Purvanchal Hills: Eastern Himalayas occupy Arunachal Pradesh and Bhutan. Important hills in this region are Aka hills, Daphla hills, Miri hills, Mishmi hills and Namcha Barwa and Dihang Pass of Arunachal Pradesh which is also its parts. Passing from Arunachal Pradesh, there is an eastward extension of the Himalayas in the northeastern region of India. This is known as Purvanchal hills. Purvanchal hills comprise Patkai hills, Manipur hills, Bairal range, Mizo hills and Naga hills. It is a densely forested area, mainly composed of sandstones.

SAQ 3

Explain the west to east division of the Himalayas along with major sub-divisions.

8.6 HIMALAYA AND ASSOCIATED MOUNTAIN RANGES: PROBLMES AND PROSPECTS

Himalayas' prospects can be well understood from the fact that it is a biodiversity hotspot for several plant and animal species. It is endowed with immense natural resources, which form the base of livelihood for its people. Swift-flowing rivers from melting glaciers form an energy base for generating hydroelectric power in different parts of the region which is one of the most important resources. Besides this, the presence of different mineral resources, plant and animal species and scenic resources for tourism benefits the region. Its cultural heritage helps promote ecotourism in the region and can also be considered a boon for the economy.

However, the urge for greater prosperity and infrastructural development that has taken place in the fragile mountain ranges has proved to be a great

disadvantage. Development-induced destruction like deforestation, mining and blasting of mountains and construction of power generation dams of large capacity is proving to be a serious threat to its environment. The changing climate in the Himalayan mountains has started showing its destructive nature in the form of GLOF (Glacial Lake Outburst Floods) recently seen in a few mountainous states of India, variability in weather phenomena and various other environmental hazards. Poor lithology and geological characteristics of young fold Himalayan mountains have been some of the greatest disadvantages over the years.

Table 8.7 highlights the region-specific constraints in Himalayan region based on two broad agro-climatic regions i.e., Western Himalayan region and Eastern Himalayan region.

Table 8.7: Region-Specific Constraints in Himalayan Regions

Agro-climatic	States	Region-specific Constraints
Western Himalayan	Jammu and Kashmir, Himachal Pradesh, Uttarakhand	Severe soil erosion, degradation due to heavy rainfall/floods and deforestation, poor road, poor input delivery, inadequate communication infrastructure and marketing
Eastern Himalayan	NE States, Sikkim, Assam	Aluminium toxicity and soil acidity, soil erosion and floods, shifting cultivation, non-availability of electricity, poor road, poor input delivery system and communication infrastructure

(Source: After Planning Commission of India Report. In the Compendium of Statistics for the States of Indian Himalayan Region, 2010. G.B. Pant Institute of Himalayan Environment and Development, Almora)

SAQ 4

Explain the problems and prospects of the Himalayan region as a whole.

8.7 SUMMARY

In this Unit, you have learnt the following:

- One of the chief macro-regions of India i.e., the Himalaya and its associated mountain ranges.
- Himalayan mountain is a separate unit of the macro-region, which also supports the other regions.
- It has diversified characteristics and geographical characteristics.
- The physical setting, cultural settings, and regions of the Himalaya and its associated mountain ranges.
- Associated problems and prospects of the Himalaya and its associated mountain ranges.

8.8 TERMINAL QUESTIONS

1. Write a note on the Himalayas and their physiographic divisions.
2. Explain the distribution of soil and vegetation types in India.
3. Write a note on water resources of India keeping in mind the role of the Himalayan drainage system.
4. The Himalayan ecosystem has been well endowed with natural resources. Explain the problems and prospects associated with the resources available in the Himalayan region.
5. Write a note on the mountain economy citing examples from the Himalayas.

8.9 ANSWERS

Self-Assessment Questions (SAQ)

1. a) The Himalayas can be sub-divided into three major divisions and their geographical attributes can be understood in the following divisions:

   i) Himalayan Ranges, ii) Trans Himalayas, and iii) Eastern Himalayas. Each of these divisions can further be sub-divided.

   b) The Himalayas are the sources of many perennial rivers which drain into the Bay of Bengal and the Arabian sea. There are a large number of perennial rivers that have their source in the snowfields and glaciers in the Himalayas, of which more than 70 percent of India's territory drains into the Bay of Bengal via the Ganges-Brahmaputra river system.

   c) Himalaya is endowed with rich physical resources. The presence of flora and fauna of different varieties makes it a unique place for different species to thrive. The suitability of climate and availability of rainfall along with the varying degree of temperature based on altitudinal changes makes it a habitat suitable for living for a variety of plants and animal species.

2. a) The Himalayas are spread across five countries - India, Nepal, Bhutan, China, and Pakistan. Four noticeably different cultural groups exist in the Himalayas namely Buddhists, Hindus, Islam followers, and Animistic groups.

   b) Economic conditions in the Himalayas partly depend on the limited resources available in different parts of that vast region of varied ecological zones. The principal activity is animal husbandry, but forestry, trade, and tourism are also important.

   c) Trails and footpaths long were the only means of communication in the Himalayas. Although, those continue to be important, especially in the more remote locations, road transport now has made the Himalayas accessible from both north and south directions.

3. From west to East, the Himalayas have been divided into six regions viz., Kashmir Himalayas, Himachal Himalayas, Kumaon Himalayas, Central and Sikkim Himalayas, Arunachal Himalayas, and Purvanchal Himalayas.
4. The Himalayas' prospects can be well understood from the fact that it is a biodiversity hotspot for several plant and animal species. It is endowed

with immense natural resources, which form the base of livelihood for the people in the region.

Terminal Questions

1. Refer to sub-Sections 8.3.1, 8.3.2 and Section 8.5.
2. Refer to Section 8.3.5
3. Refer to sub-Section 8.3.3.
4. Refer to Section 8.6.
5. Refer to sub-Section 8.4.3.

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UNIT 9

MACRO REGIONS OF INDIA 2

Structure

9.1 INTRODUCTION

In this Unit, you will learn about Indo-Ganga and Brahmaputra plains as macro regions of India. You will be able to know about the historical background, physical setting, and cultural setting of this macro-region. It will also discuss different sub-regions within the region and study its problems and prospects.

Indo-Ganga and Brahmaputra plains have geographical importance as it is an important macro-region in northern part of the country, which is drained by three great river systems of Indus, Ganga and Brahmaputra. This is the Great plains region of India, densely populated and intensely cultivated. It is divided into three regions: 1) Indus plains 2) Ganga plains, and 3) Brahmaputra plains. The gradational activities of rivers like Indus, Ganga and Brahmaputra, and their numerous tributaries have contributed to their formation and origin. Indo-Ganga and Brahmaputra plains are largest alluvial tract of the world, forming the world's largest delta, Sundarbans. The northern boundary is well marked by Shivalik hills. The southern boundary is wavy and irregular along northern edge of Peninsular India, with the western border marked by the Sulaiman and

Kirthar ranges. On the eastern side, the plains are bordered by Purvanchal hills. The Great plains cover an area of 700,000 square kilometres.

The Indo-Gangetic and Brahmaputra plain is an expansive and rich geographical area that has substantially impacted the history, culture, and economy of the Indian sub-continent. This vast expanse of territory is located south of the Shivalik hills and is defined by the Himalayan Front Fault (HFF). It acts as a transitional region between the Himalayas in the north and Peninsular India in the south. The region includes the Indo-Gangetic-Brahmaputra plain, which is acknowledged as the most extensive alluvial tract globally. Altitude above mean sea level in the Northern plains of India is around 200 metres, suggesting a mostly flat terrain that is very suitable for agriculture and has a high population density.

Expected Learning Outcomes

After studying this Unit, you should be able to:

- examine a brief history of Indo-Ganga and Brahmaputra plains regions;
- understand the nature of physical setting of Indo-Ganga and Brahmaputra plains regions;
- understand the nature of cultural setting in Indo-Ganga and Brahmaputra plains regions;
- explore the regions of Indo-Ganga and Brahmaputra plains; and
- comprehend the problems and prospects of Indo-Ganga and Brahmaputra plains regions.

9.2 INDO-GANGA AND BRAHAMPUTRA PLAINS: HISTORICAL BACKGROUND

The Indo-Gangetic and Brahmaputra plains possess a profound and intricate historical heritage that extends over several millennia, serving as a crucial catalyst in the development of South Asian civilisation. These plains have served as the origin of ancient civilisations, the site of conflicts between empires, and the location where religions and cultural movements were born. History of Indo-Ganga plains region is very ancient, as the Indus Valley Civilisation extended till Ropar (today's Rupnagar), an urban settlement in this plain region. Even Kurukshetra battlefield of the Mahabharata era is situated within this region. This region has seen great kingdoms of ancient India, which are the Mauryas and the Gupta Kingdoms. This region also witnessed the rise of religions like Hinduism, Buddhism, Jainism, and Sikhism. Later, even during the times of Muslim rulers, especially the Mughals, the area had strategic importance. This part of India has always been the centre of diplomatic and political activities. Indo-Ganga plains region can be seen as entry point into India through the plains route.

Brahmaputra plains are a vast region in South Asia formed by Brahmaputra river and its tributaries. This region holds significant historical, cultural and economic importance. Since ancient times, Brahmaputra river has been a lifeline for the people of this region. The plains were inhabited by various indigenous communities, and the river played a crucial role in their daily lives

as well as livelihood. This region was influenced by various medieval kingdoms, including the Ahoms, who migrated to Brahmaputra valley in 13th century and established Ahom Kingdom. Ahoms ruled the region for several centuries. Ahom Kingdom, with its capital at Sivasagar (formerly Rangpur), dominated Brahmaputra plains for about 600 years. Ahoms were known for their administrative skills, military prowess, and cultural contributions.

Mughals, followed by British, attempted to expand their empires into Brahmaputra plains. Ahoms successfully resisted Mughal invasions in 17th century. However, the British East India Company gradually annexed the region during 19th century. Brahmaputra valley became part of British India, and tea cultivation became a significant industry in this region. The British introduced tea plantations, changing the natural landscape and economy of Brahmaputra plains.

Provided below is a concise summary of the historical context of this area:

Ancient Civilisations and Empires

- The **Indus Valley Civilisation**, which existed from around 2600 BCE to 1900 BCE, first established urban communities mainly in the western area of the Indo-Gangetic plains. However, its impact spread over the whole region. This civilisation established the fundamental basis for later civilisations and communities in South Asia.
- **Vedic Period:** The Vedic literature, created between 1500 BCE and 500 BCE, is said to have originated on the Indo-Gangetic plains. The writings embody the early Indo-Aryan civilisation that exerted dominance over the area, imposing social hierarchies and religious customs that have undergone gradual changes over the years.
- **Maurya and Gupta Empires:** The Maurya Empire (approximately 322 BCE to 185 BCE) and the Gupta Empire (roughly 320 CE to 550 CE) thrived on these plains, which are regarded as the core regions of both empires. These periods are widely recognised as golden eras in Indian history, characterised by remarkable progress in the fields of arts, science, and government.

Medieval Period

- **Islamic Sultanates and the Mughal Empire:** From the 12th century onwards, a succession of Islamic empires and sultanates emerged in the area, ultimately leading to the establishment of the Mughal Empire (1526–1857). The Mughals were famous for their significant contributions to architecture, culture, and the arts, as shown by iconic structures like the Taj Mahal.

Colonial Era

- **British Raj:** During the Colonial Era, the British Raj focused on the Indo-Gangetic and Brahmaputra plains as crucial areas for agricultural productivity and commercial activities in India. The British implemented railroads, telegraph lines, and a centralised government, greatly influencing the social, economic, and political structure of the province.

Post Independence

- **Partition and Independence:** Following India's independence, the partition of the country in 1947 resulted in notable population shifts across the Indo-Gangetic plains, namely in Punjab and Bengal, which were split between India and Pakistan. During the years after independence, there have been endeavours to tackle issues like increase in population, urbanisation, and the need for environmental sustainability, all while using the agricultural and economic capabilities of the area.

Modern Developments

- **Economic and Social Progress:** Over the last several decades, the Indo-Gangetic and Brahmaputra plains have seen significant economic expansion, urbanisation, and enhancements in infrastructural amenities. Nevertheless, the area also has obstacles with environmental stewardship, preservation of resources, and fairness in society.
- After India gained independence in 1947, the Brahmaputra plains became part of the Indian state of Assam. The region has witnessed various socio-political movements, including demands for autonomy and identity by different ethnic groups. The history of the Brahmaputra plains is a complex and dynamic narrative shaped by the interactions of various cultures, civilisations, and natural forces over centuries.

Historical context of the Indo-Gangetic and Brahmaputra plains underscores the region's importance as a hub of political influence, cultural advancement, and economic productivity. History of these two macro regions exemplifies the capacity of its inhabitants to bounce back from challenges and adjust to new circumstances. It also highlights their significant contributions to the overall fabric of South Asian history.

9.3 INDO-GANGA AND BRAHAMPUTRA PLAINS: PHYSICAL SETTING

9.3.1 Geology

The Indo-Gangetic and Brahmaputra plains include expansive alluvial terrains, characterised by lush soils and substantial agricultural output. These formations were created over millions of years by the process of sedimentation, which resulted from rivers coming from the Himalayas and Peninsular plateau. The creation began with the tectonic convergence of the Indian plate and the Eurasian plate, resulting in the elevation of the Himalayas and the Tibetan plateau. The newly formed Himalayas and the northern half of the Peninsular plateau experienced significant erosion, resulting in large quantities of sediment deposition. These sediments were then transported by rivers such as the Ganges, Brahmaputra, Indus, and their tributaries. The alluvial deposits, composed of silt, sand, and clay, are the most recent on the top and get older and denser as they go deeper. The region's abundant and productive soils, underground water sources, active river systems, and geological movements contribute to its diversified and prosperous nature. The seismic activity in the area is further influenced by its proximity to the tectonically active Himalayan zone.

The region is characterized by distinct regional geomorphic features, including river alluvium descending from Shivalik, folded Shivalik ranges, and the Peninsular plateau. The region is a water-flowing zone of rivers like the Indus, Ganges, and Brahmaputra, which form depositional landforms around the plain. The evolution of Brahmaputra plains began in the Quaternary period and continues to evolve due to relief in the foreland depression between the Himalayas and the Shillong plateau. The Brahmaputra valley is in perpetual flux due to erosional and depositional works of rivers, channel migration, and disastrous earthquakes, making it extremely unstable. The region's geological structure is new and evolving over time.

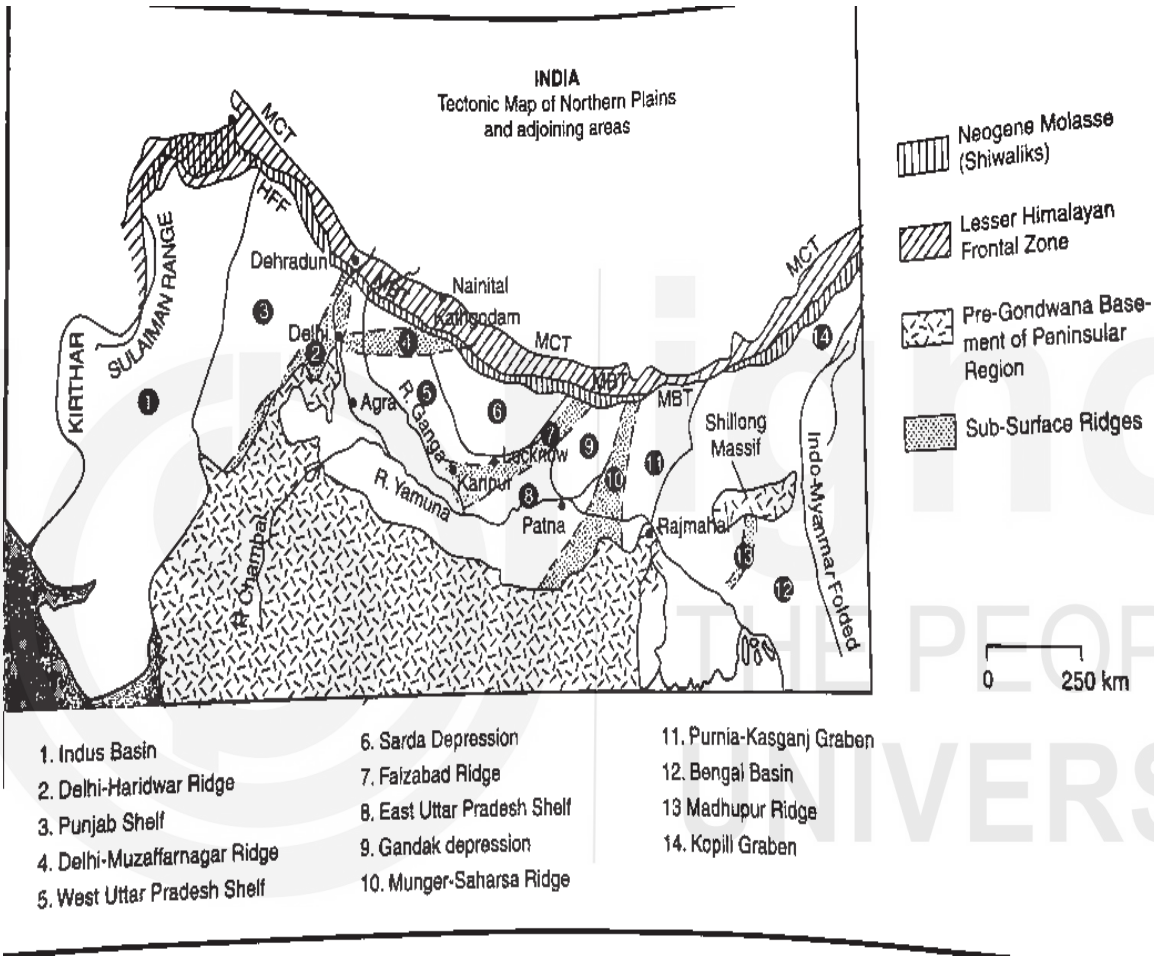

Fig. 9.1: Geological Map of Indo-Ganga and Brahmaputra Plains.
(Source: Singh, R.L. ed. (1971). India: A Regional Geography. National Geographical Society of India)

9.3.2 Physiography/Relief

Indo-Ganga plains region is of recent origin made up of sediments brought by the Himalayan rivers. The plains are topographical flat for hundreds of miles. Only relief features perceptible to eye have been formed by floodplain bluffs, minor natural levees and hollows grouped by Geddes as ‘spill patterns,’ and the belts of ravines and badlands formed by gully erosion along some of larger streams. For example - in the lower Chambal; slopes of broad interfluves or doabs are bare, if at all perceptible. On this vast aggradational surface, only marked topographical changes are those associated with the numerous shifts and diversions of the rivers. However, these are of great importance as Geddes points out, the plain on Himalayan side is built-up of great alluvial cones, interlocking ‘inter-cones’. On these cones, the rivers

swing from side to side. At present, this is most notable on Kosi river giving her the name ‘sorrow of Bihar’.

Older (Pleistocene) alluvium is known as bhangar and occupies higher level than recent alluvium called khadar, which occupies floodplains and grades into most recent deltaic silts. The bhangar in Bengal delta forms low and sometimes lateritic uplands as seen in Barind and Madhupur forest. Generally, alluvium is stiff clay, with sand according to whether it is near to or far from hills; in bhangar, there are irregular limey concretions (kankar), and in places, there may be as much as 30 percent of calcareous matter in alluvium.

Brahmaputra plains are characterised by Pleistocene and recent alluvial deposits (brought down every successive year). This region represents easterly extension of Indo-Gangetic alluvium. Brahmaputra plains are the result of ongoing dynamic processes of sedimentation in the longitudinal valley. It is located between the Himalayas on the north, Patkai-Barail highlands on the south-east and enclosed by hard continental block of Shillong plateau to the south.

Upper portion of the plains extend from northeast to southwest, but the lower part goes due east-west. The plain is at its broadest in the upper part about 90 kilometres and narrowest in the middle part where Karbi plateau projects northward to the bank of Brahmaputra at Burapahar, reducing the plain to meagre 50 kilometres width. Towards west, the plain spreads to become narrow again at Guwahati and opens out further west as Garo hills of Meghalaya plateau recedes southward.

The plain as a whole slopes down towards south-west in higher section and west in the middle and lower portions. However, the incline is relatively gentle. For example, altitude of Kobo near tri-junction of Dihang, Dibang and Lohit is 130 metres. Then, 96 kilometres downstream at Dibrugarh the height is 103.6 metres. Similarly, altitude of Guwahati, Goalpara and Dhubri are only 50.5 metres, 36.9 metres and 27.8 metres, respectively. The fall in the gradient is therefore, only 13 centimetres per kilometre on average. Such a long and gentle gradient is one of the primary reasons of frequent floods in the plains following heavy rainfall and constant deluge during southwest monsoon.

An intriguing aspect of the plain is existence of succession of hillocks on either banks of Brahmaputra, notably in its middle and lower sections. These hillocks are formed of old granitic and gneissic rocks and are geologically part of Karbi-Meghalaya plateau.

The physiography and terrain of the Indo-Ganga and Brahmaputra plains, a vast expanse of fertile land, exhibit many distinctive characteristics:

Flatness and Fertility: The Great North Indian plain is primarily characterised by its flat topography, with a gentle incline from west to the east. The flatness of this area is a consequence of the massive accumulation of alluvial sediment over thousands of years by several rivers that traverse the plains, such as the Indus, Ganga, and Brahmaputra, together with their numerous smaller streams. Soil in this region is very rich owing to the deposition of alluvium by various river systems. As a result, it supports the highest population density in India, due to its high agricultural output.

The plain is conventionally partitioned into three segments:

The Punjab Plains: It is primarily shaped by the five rivers of Punjab (Jhelum, Chenab, Ravi, Beas, and Sutlej), which are renowned for their fertile alluvial soil. It is highly suitable for agricultural activities, notably the growth of wheat and rice.

The Ganga Plains: It spans many states from Uttar Pradesh to West Bengal, are located in the central region of the North Indian plain. This region has a diverse landscape, with riverine islands, winding rivers, and oxbow lakes. The plains in this area are distinguished by the presence of doabs, which are rich tracts of land located between two converging rivers.

The Brahmaputra Plains: The Brahmaputra plains, located in the eastern region, is characterised by a complex network of interwoven river systems and extensive sediment accumulation. The region is susceptible to yearly floods that, whilst inflicting harm, also enrich the soil with new alluvium, thereby preserving its fertility. The Brahmaputra plains, a part of the Indo-Gangetic alluvium, are an easterly extension of the Himalayas. They have been formed through sedimentation in the longitudinal valley between the Himalayas, Patkai-Barail highlands, and the Shillong plateau. The upper part of the plains extends from northeast to southwest, while the lower part goes east-west. The plain is broadest in the upper part, about 90 kilometres, and narrowest in the middle, where the Karbi plateau projects northward to the bank of Brahmaputra at Burapahar, reducing the plain to meagre 50 kilometres width. The plain slopes down towards the south-west in the higher section and west in the middle and lower portions, with an average gradient of 13 centimetres per kilometre. This gentle gradient is one of the primary reasons for frequent floods in the plains. Although Brahmaputra plain is by and large flat, it has some physiographic variations.

Brahmaputra valley can be divided into four notable physiographic units:

i) The northern foothills
ii) The north and south bank plains
iii) The floodplain and charlands, and
iv) The southern foothills

Geomorphological Features: The region's topography is distinguished by several geomorphological characteristics, including levees, floodplains, terraces, and river cliffs. The long-term interplay between rivers and the terrain has resulted in a diverse array of geomorphological formations, each of which has specific consequences for how the land might be used.

Fluvial Processes and Landforms: The region experiences significant fluvial activities that result in the creation of many landforms, including deltas found at the river mouths. One notable example is the Sundarbans Delta, which is produced by the Ganga and Brahmaputra rivers. Meanders and point bars are often seen along the courses of these rivers.

Relief and Elevation: Although the plain is mostly flat, it exhibits subtle undulations and height fluctuations. The elevation is greatest in the western part, where it intersects with the Pakistan border, and gradually declines

towards the east and south, where it blends with the delta area. The elevation in the top portions of the plain varies between about 200 and 300 metres above sea level, while in the lowest parts it is less than 200 metres.

Soil and Sedimentation: The region's soil composition is intricate, consisting of sandy loam near the rivers and clayey soils in the more distant locations. The dynamic floodplains are regularly refilled with new alluvium, maintaining excellent soil fertility.

9.3.3 Drainage and Water Resources

There are three major river systems in **Indo-Ganga and Brahamputra plains** with their numerous tributaries. These are Indus, Ganga and Brahmaputra river system which comprise drainage and water resources of this macro region. All these rivers originate from the higher slopes of diverse mountain ranges of mighty Himalayas.

Indus River System

a) Indus River: Indus is India's westernmost river of the Great Northern plains. It has a length of 2880 kilometres, of which 709 kilometres lies in India. Main tributaries of river Indus are Jhelum, Chenab, Ravi, Beas and Satluj. All these rivers are tributaries or sub-tributaries of Indus which finally falls into Arabian Sea. Indus river originates from Bokhar Chu glacier situated near Mt. Kailash. The river in the plain area forms one of the most fertile plains which have supported oldest civilisation of the Indian sub-continent.

b) Jhelum River: Jhelum river rises from a spring at Verinag in the south-eastern part of valley of Kashmir. It joins Chenab river at Trimmu. Its gradient is gentle in Kashmir valley and is the most important river of Kashmir, supporting lives and livelihood there.

c) Chenab River: Chenab river is formed by uniting Chandra and Bhaga. It flows across Pir Panjal and Great Himalayan mountain ranges. It makes a hairpin bend near Kishtwar and flows across Pir Panjal range at Raisi to enter Pakistan. There are some important hydel projects on the river such as Baglihar Hydroelectric project, Salal, and Dulhasti projects etc.

d) Ravi River: It flows for about 725 kilometres and drains 5957 square kilometres area in India. Ravi rises near Bara Bhangal in Kangra district of Himachal Pradesh. It drains western slope of Pir Panjal and northern slope of Dhauladhar mountain ranges.

e) Beas River: Beas has its source at Beas Kund near southern face of Rohtang pass in Kullu, where it runs for a few kilometres and then cuts through Dhauladhar range. It flows through towns of Manali and Kullu.

f) Satluj River: Satluj river rises from Rakas lake, which is situated at about 4600 metres near Mansarovar lake in Tibet (China). This is an antecedent river, called Langchen Khambab in Tibet. It enters through Shipki La pass in India. Bhakra dam is constructed on this river. In India, its course is 1050 kilometres, draining an area of about 28,090 square kilometres.

Ganga River System

a) Ganga River: Ganga is India's most important and sacred river. Ganga originates as Bhagirathi from Gaumukh in Uttar Kashi district of Uttarakhand at an elevation of about 7010 metres. River Alaknanda joins Bhagirathi river at Devprayag forming Ganga. The main tributaries of river Ganga are Yamuna, Chambal, Gandak, Kosi, and Son.

b) Yamuna River: It is the longest and western-most tributary of Ganga. Its source lies in Yamunotri glacier on the western slopes of Banderpunch. Downwards, it is joined by Tons river behind Mussoorie range.

c) Chambal River: Chambal river rises near Mhow Cantt situated at southwest of Indore in Malwa plateau from Vindhyan range and flows towards north in a gorge upto Kota in Rajasthan state. This river is tributary of Yamuna river. Chambal river is known for its extensive ravines carved all along lower Chambal valley.

d) Gandak River: Draining central parts of Nepal, Gandak river rises in Himalayas between Dhaulagiri, Annapurna and Mt. Everest in Tibet. It enters the great plains of India in Champaran district of Bihar.

e) Kosi River: Kosi is also an antecedent river known as the 'Sorrow of Bihar'. After piercing the Greater Himalayas in Nepal, it is joined by the Sun-Kosi from the west and Tamur-Kosi from the east. The river is notorious for its floods.

f) Son River: This is a large south bank tributary of Ganga river. It originates from Amarkantak plateau not far from the source of Narmada. It leaves the plateau making series of waterfalls and meets Kaimur range, which turns its course towards north-east, where it follows a strike valley.

Brahmaputra river originates from glaciers lying to the east of Mansarovar lake, at an elevation of 5150 metres. The river is known as Tsangpo in Tibet. It pierces the Greater Himalayas near Namcha Barwa. In India, the river is known as Brahmaputra. The river has several tributaries such as Subansiri, Manas, Tista, Dihang, and Lohit. Watered by numerous rivers, the valley is exceedingly fruitful. As many as 32 significant north and south bank tributaries drain the entire span of Brahamputra valley. Some tributaries of Brahmaputra are snow-fed, although the bulk of them depend on the monsoons for their water volume. These dry up during winter but, together with rains, swell up and exceed their banks and, at times, cut to create fresh routes through alluvial material of the valley. Distinguished by their geo-hydrological characteristics, these tributaries have played important role in the valley's wetland ecology. River Brahmaputra drains the valley from Sadiya to Dhubri over a distance of around 640 kilometres.

Brahmaputra with a well-knit network of several north and south bank tributaries flows along the entire valley, feeding water and material into its wide floodplain.

Important north bank tributaries of the Brahmaputra include Subansiri, Jia Bharali, Dhansiri, Puthimari, Pagladiya, Manas, and Champamati. On the other hand, the primary south bank tributaries are BuhriDihing, Disang, Dikhow, Dhansiri, Kopili, and Krishna.

9.3.4 Climate

Three types of climatic conditions prevail in this region: i) sub-humid, ii) semi-arid, and iii) humid. Extreme hot and cold conditions are the basic characteristics as temperature in the region range between 20°C and 40°C. Months of May and June experience hot and dry winds, locally called loo, followed by dust winds and occasional showers. Rainfall is mainly received in the months of July, August, and September. However, western depressions/ disturbances also bring a few centimetres of rainfall during winter months in parts of Indo-Ganga plain. This winter rainfall is quite useful for Rabi crops.

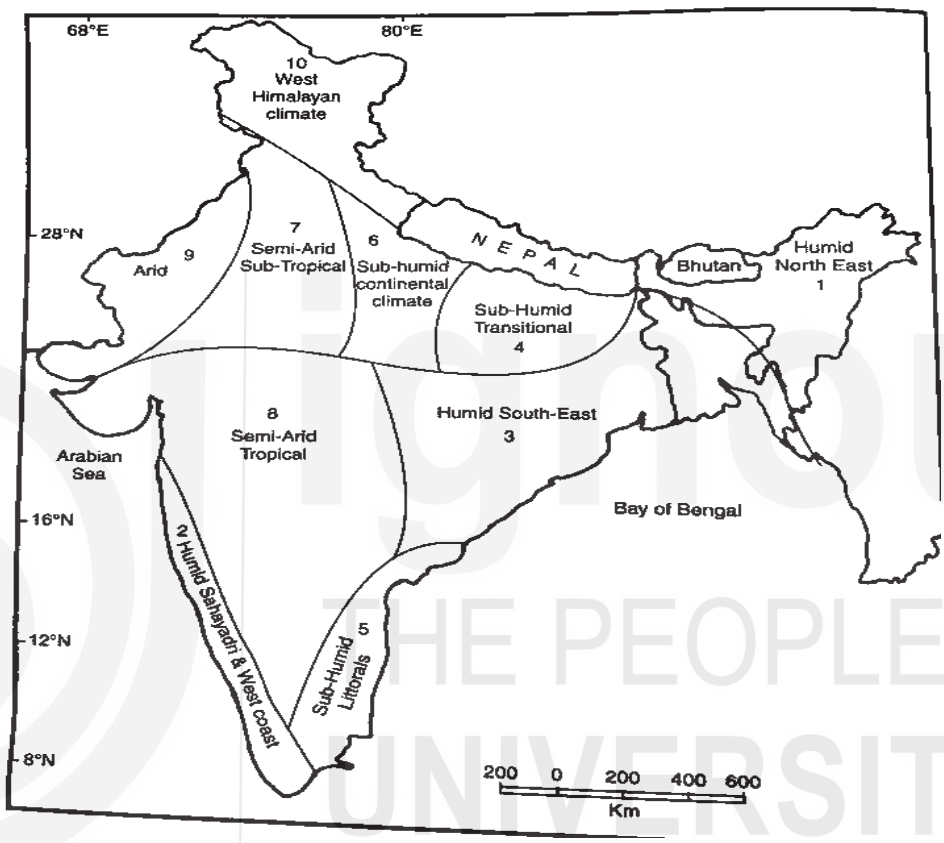

Fig. 9.2: Climatic Divisions of Indo-Ganga and Brahamputra Plains.
(Source: Singh, R.L. ed. (1971). India: A Regional Geography. National Geographical Society of India)

According to R.L. Singh's (1971) climatic divisions, the region has been divided into five sub-divisions from west to east namely i) arid; ii) semi-arid, sub-tropical; iii) sub-humid continental climate; iv) sub-humid transitional; and v) humid-northeast.

Brahmaputra plains have been experiencing extreme humidity and significant rainfall during monsoon. Brahmaputra plains are within the regime of monsoon climate of sub-tropical humid belt. The plains have been experiencing hot and moist summer with significant rainfall and chilly dry winter with low rainfall. There are substantial spatio-temporal fluctuations of climatic conditions in the region because of its unique location and physiography. Seasonal shift in pressure situation over the Bay of Bengal and north-western Indian sub-continent, tropical oceanic air masses with southwest monsoon, flow of local mountain and valley winds and presence of river basins affects weather of this region.

Brahmaputra valley experiences four well-defined seasons, viz:

i) pre-monsoon,
ii) monsoon,
iii) retreating monsoon, and
iv) dry winter.

i) Pre-monsoon

The pre-monsoon season spans from early March to the end of May, preceding the onset of the monsoon rains. During this period, the plains receive a substantial amount of rainfall, primarily induced by meteorological depressions locally known as **Bardaichila**. The mean rainfall during this season is approximately 15.6 centimetres, providing much-needed moisture to the parched land after the dry winter months. The temperature during the pre-monsoon season averages around 22°C, creating relatively mild and comfortable conditions. However, occasional heat waves may occur, particularly towards the end of the season when the temperature starts to rise in anticipation of the monsoon rains.

ii) Monsoon

The monsoon season, typically commencing in June and lasting until the middle of September, is characterised by heavy rainfall and thunderstorms, which are a hallmark of the monsoon climate. The Brahmaputra plains receive a significant portion of annual rainfall during this period, with average precipitation ranging around 200 centimetres. The monsoon rains are vital for replenishing water sources, nourishing crops, and sustaining the region's ecosystems. However, the heavy downpours also pose challenges, as they often lead to flooding and inundation, causing damage to infrastructure, agriculture, and livelihoods. The high humidity levels during the monsoon season which is combined with the saturated air create muggy and uncomfortable conditions, making it imperative for residents to adopt appropriate measures to mitigate the impact of the monsoon rains.

iii) Retreating Monsoon

The retreating monsoon marks the transition from the monsoon season to the dry winter months and typically occurs from later part of September to first half of October. During this period, the south-west monsoon begins to withdraw from the Brahmaputra plains, as a response to which rainfall intensity decreases. While sporadic showers may still occur, overall precipitation levels decrease as the monsoon winds retreat towards the Indian Ocean. The retreating monsoon season provides a brief respite from the heavy rains, allowing communities to assess and recover from the impacts of flooding and prepare for the upcoming dry winter season.

iv) Dry Winter

The dry winter season spans from the middle of November to the end of February and is characterised by low temperatures, cold and dry weather, and morning fog. The winter month’s average temperature ranges between 10°-12°C, with occasional dips below freezing in some areas. The clear skies and dry conditions make the best time for outdoor activities and sightseeing, with visitors drawn to the region's scenic beauty and cultural attractions.

However, the cold temperatures can also pose challenges, particularly for vulnerable populations and those living in inadequately insulated homes. Despite the chilly weather, the dry winter season offers a welcome reprieve from the monsoon rains, allowing communities to engage in agricultural activities such as harvesting and sowing winter crops.

9.3.5 Vegetation

The Indo-Gangetic and Brahmaputra plains in northern and eastern India include various plant types, influenced by the region's unique temperature, soil composition, and water resources. The plains in question are very rich and heavily inhabited areas of India, characterised by a combination of forest, and grassland. Indo-Gangetic plains or Great Northern plains are characterised by varied vegetation types. Natural vegetation can be seen under desert type comprising cacti and babul common. Area adjoining Shivalik hills has moist deciduous forest with Sal and Teak as common trees. Area south to it has dry deciduous vegetation with trees like Acacia, Jamun and Mango etc. Vegetation of the region is very diverse because of differences in rainfall along the course of whole area of the plains.

Numerous vegetation types, such as evergreen, semi-evergreen, deciduous, and degraded scrubs, make the forest landscape in the **Brahamputra** plains, more diverse and richer as compared to Indo-Ganga plains. Evergreen and semi-evergreen vegetation is found in districts of Dibrugarh, Sibsagar, Jorhat, Golaghat, Lakhimpur, Sonitpur, Nagaon, Darrang, Kokrajhar and Dhubri. Deciduous forests of Sal, Teak, Gamari, Sisso, etc. exist in Barpeta, Dhubri, Kokrajhar, Goalpara, Nalbari, Kamrup, Nagaon, Dibrugarh, Sonitpur and Sibsagar districts. Brahmaputra plains have tropical evergreen vegetation with Bamboo and Gurjan etc., as common plants.

Below is a comprehensive summary of the many plant kinds present in these plains:

Tropical Deciduous Forests: Tropical deciduous woods are the dominating vegetation in places with comparatively higher precipitation, particularly in the eastern regions of the Gangetic plains and across the Brahmaputra lowlands. The distinguishing feature of these woods is the diverse array of trees that undergo leaf shedding in order to preserve water during the dry season. The primary species are Sal (Shorea robusta), Teak (Tectona grandis), as well as other kinds of Acacia and Bamboo. The woodlands possess a high level of biodiversity, providing habitat for many animal and avian species.

Grasslands: The floodplains next to the rivers, particularly in the Brahmaputra valley, sustain luxuriant grasslands that serve as vital habitats for diverse animals, including the single-horned rhinoceros, elephants, and several kinds of deer. These grasslands also function as crucial pastures for domesticated cattle and are essential for their sustenance.

Riparian Vegetation: Vegetation is found along a river's banks or other water bodies. Riparian vegetation, including of thick bushes, trees, and aquatic plants, flourishes along the banks of the rivers that intersect the plains. This plant type is crucial for the stabilisation of riverbanks, the mitigation of erosion, and the provision of habitat for a multitude of aquatic and avian species.

Mangroves: Mangroves are present in the delta areas, particularly in the Sundarbans located at the estuaries of the Ganges and Brahmaputra rivers. The tidal ecosystems include salt-tolerant flora and fauna, including the Bengal tiger. Mangroves are essential for safeguarding the shoreline from erosion and severe weather phenomena.

The flora of the Indo-Gangetic and Brahmaputra plains is of utmost significance in shaping the region's ecological balance, economic activities, and cultural practices. The area maintains a diverse range of plant and animal species, offers crucial functions to the environment, and ensures the continued success of farming activities. Nevertheless, these plant types are confronted with dangers arising from deforestation, habitat fragmentation, and the consequences of climate change. Consequently, it is imperative to undertake conservation and sustainable management measures to protect and preserve these crucial natural resources.

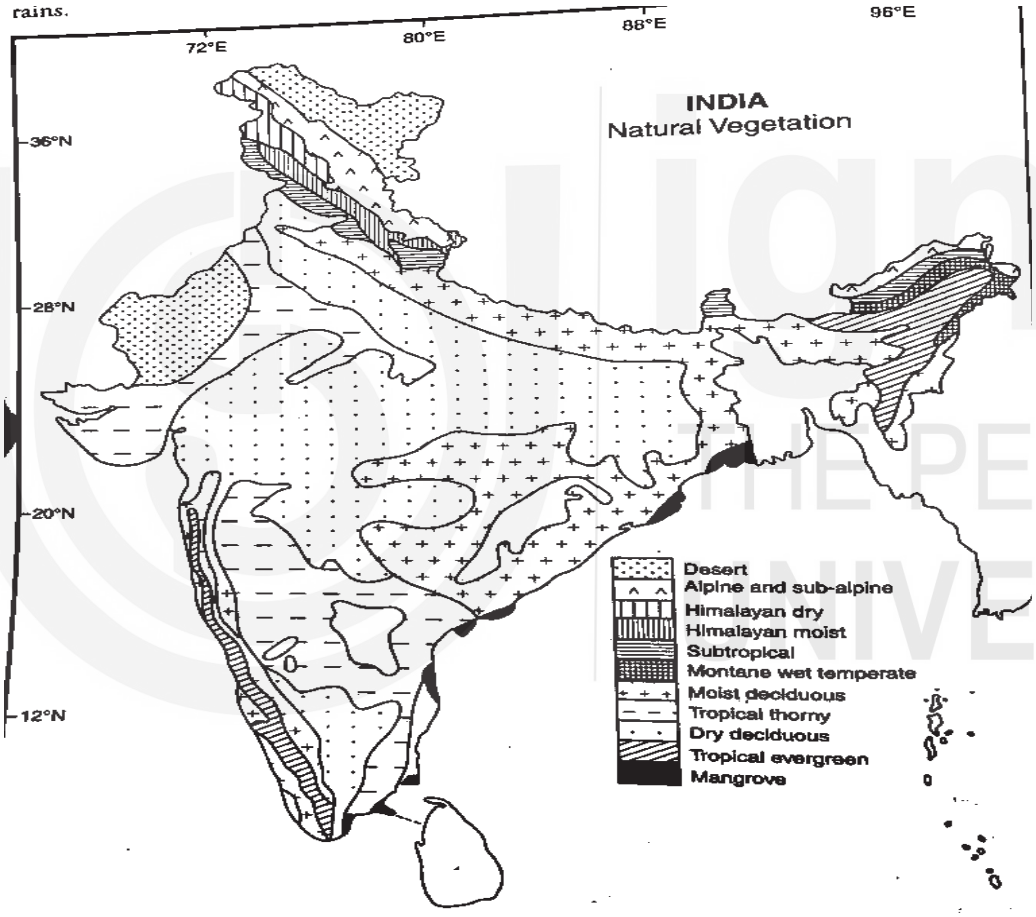

Fig. 9.3: Natural Vegetation of Indo-Ganga and Brahamputra Plains.
(Source: Singh, R.L. ed. (1971). India: A Regional Geography. National Geographical Society of India)

9.3.6 Soils

Indo-Ganga plains predominantly comprise alluvial which is among the most fertile soils in the world. Rajasthan plain's western side has desert soil with thorny vegetation. Alluvial soil has two divisions called Bangar and Khadar. Bangar soil is older alluvium whereas khadar soil is made up of newer alluvium, which gets renewed by flood.

Brahmaputra alluvium soil is partly new or recent and partly old. Overall, soil is of sandy loam kind. Acid-soluble fraction in soil does not generally exceed 20 percent. Percentage of organic material and nitrogen is fairly adequate. All soils are acidic, and phosphorus contents of aqueous solution vary from 4.5 to 6.0. Recent alluvium has high phosphorus, even more than 7.0, whereas old alluvial soil has very low phosphorous.

Brahmaputra valley has diverse soil types due to its diverse geological, geographical and agro-climatic factors. Alluvial and piedmont soils are abundantly scattered over the region. Two types of alluvial soil, younger and old, are found. Young alluvium occurs widely around north and south river banks, including floodplains and charlands areas. Newer alluvium soil, comprises mainly of sand to silty loams, and is extremely dark to grey in colour. This soil lacks phosphoric acid, nitrogen and humus content.

Old alluvium is present in some sections of Kokrajhar, Barpeta, Nalbari, Kamrup, Darrang, Sonitpur, Lakhimpur and Dhemaji districts between northern piedmont soil belt and southern new alluvial soil of the valley. Unlike new alluvial soil, old alluvium is quite deep, brownish to yellowish brown, with texture of fine loam to coarse loam, and is slightly to moderately acidic.

Piedmont soil comprises Bhabar and Tarai soil, which is confined to northern Himalayan foothills. Bhabar soil exists along Assam-Arunachal border, running from Bongaigaon district in west to river Subansiri in east. The soil is characterised by unassorted debris of boulders, pebbles, cobbles, sand and silt. Bhabar soil is fine to coarse loamy in texture.

Tarai soil is found in several discontinuous narrow spots in between Bhabar soil belt and alluvial soil. This soil extends from Kokrajhar to Dihang river. Tarai soil is sandy to silty loam and remains saturated. Hill soil is mainly found in southern hilly portions of the valley. This soil is deep, dark greyish brown in hue and fine to coarse loamy in texture. Lateritic soil is seen on southern edge of Golaghat district. This soil is dark and fine textured with heavy loam.

The Indo-Gangetic and Brahmaputra plains are distinguished by their abundant and fertile soils, which serve as the basis for the agricultural production that distinguishes this extensive area. These plains, which extend across many Indian states, are endowed with diverse soil types, each conducive to distinct cropping patterns and flora kinds. Below is a summary of the soil attributes observed across these plains:

Alluvial soils: Alluvial soil is the prevailing soil type in both the Indo-Gangetic and Brahmaputra plains. These soils are exceptionally productive and excellent for a wide variety of crops since they are formed from the sediments carried by rivers originating from the Himalayas and the Peninsular plateau. Alluvial soils are often characterised by their lightweight and porous nature, which enables them to effectively store rainwater. The soils exhibit a range of textures, from sandy loam to clay loam, which contributes to their excellent agricultural productivity. The alluvial deposits undergo yearly renewal via the recurring floods, which restore the nutritional content, thereby minimising the need for use of intensive fertilizer.

Features of Alluvial Soils

- **High fertility:** These soils are abundant in potash, phosphoric acid, and lime, making them very suitable for growing crops, including rice, wheat, and sugarcane, as well as numerous pulses and vegetables.
- **Alluvial soils** have substantial variability in texture, ranging from coarse sand in the higher regions next to the riverbanks to fine silts in the lower floodplains.
- **Young soil**: Alluvial soils are geologically recent and exhibit an indistinct soil profile as a result of the ongoing accumulation of silt by river currents.

Distribution of Soil

Khadar and Bhangar are two major classifications of alluvial soils, which are formed by the deposition of sediment carried by rivers.

- **Khadar** refers to the younger alluvium, while Bhangar refers to the older alluvium. Khadar soils are mostly located in the lower regions of floodplains and undergo annual replenishment, resulting in higher fertility.
- **Bhangar** soils, in contrast, are located at higher elevations and are more ancient, characterised by a greater abundance of kankar nodules (calcium-rich concretions), resulting in somewhat lower fertility compared to Khadar soils. The alluvial soils found in the delta areas of the Ganges and Brahmaputra rivers, known as deltaic alluvium, are mostly clayey and are renowned for their exceptional fertility, particularly for growing rice.

9.3.7 Physical Resource Base

Indo-Ganga plains region is mostly devoid of minerals. Iron ore having 57 percent metal fraction is found in southern part of Aravalli range in Ghnota, Dhanoli and Narnaul. However, its production is not much. Good limestone deposits are found in districts of Ambala and Mahendragarh and slate in Mahendragarh and Gurugram. Rajasthan plains have some copper and mica deposits. Bihar part of the plain has mica deposits in Bhagalpur district.

Brahmaputra plains have mica deposits. Resource base of Brahmaputra plains is diverse and contributes significantly to economic activities and livelihood of inhabitants. The region, cradled by the mighty Brahmaputra river, boasts an agricultural landscape that serves as the bread basket for local populations and contributes significantly to the nation's agricultural output. The Brahmaputra river provides vital water resources that sustain agricultural activities, fisheries, and transportation networks. Along with its numerous tributaries, the Brahmaputra forms the main water source for irrigation, fishing, and transportation, playing a pivotal role in the socio-economic fabric of the region. The river system supports a rich aquatic ecosystem, providing livelihoods to communities engaged in fishing and related activities.

The aquatic ecosystem of the Brahmaputra river system has a range of flora and fauna, including freshwater dolphins, crocodiles, and migratory birds. The rivers and wetlands provide crucial habitats and breeding grounds for these species, contributing to the region's biodiversity and ecological health. The Brahmaputra plains possess significant hydropower potential that has been

harnessed through the construction of dams and hydropower projects. The development of hydropower infrastructure in the Brahmaputra basin has emerged as a crucial component of India's energy strategy, offering renewable and sustainable energy sources to support economic growth and development. Some notable examples of hydropower projects in the Brahmaputra basin include the Subansiri Lower Hydroelectric Project, the Ranganadi Hydroelectric Project, and the Kameng Hydroelectric Project, among others.

The Brahmaputra plains are home to diverse flora and fauna, including various species of plants, animals, and birds. At the heart of this biodiversity hotspot lies the Kaziranga National Park, a UNESCO World Heritage Site and one of the most celebrated wildlife sanctuaries in India. Spread across the floodplains of the Brahmaputra in the state of Assam, Kaziranga is renowned for its remarkable conservation efforts and its iconic inhabitant, the Indian one-horned rhinoceros (Rhinoceros unicornis). The Brahmaputra plains, nestled in the north-eastern part of India, boast dense forests that play a crucial role in the ecological and socio-economic fabric of the region. These forests, rich in biodiversity, provide a plethora of timber and other forest products, serving as a vital resource for local communities and industries.

Furthermore, they contribute significantly to maintaining ecological balance, supporting wildlife habitats, and preserving soil health. Brahmaputra Plains has various mineral resources, including coal, oil, and natural gas. These resources contribute to the energy sector and support industrial development in the region. In addition to coal, the Brahmaputra Plains are also known for their significant oil and natural gas reserves. The region is part of the Assam-Arakan basin, one of India's oldest and most prolific hydrocarbon-producing basins. Assam has been a significant player in India's oil and gas industry since the late 19th century when the first commercial oil well was drilled in the region. Oil and gas reserves have spurred the growth of the petroleum industry in Assam, with numerous exploration and production activities undertaken by both public and private sector companies.

However, exploiting mineral resources in the Brahmaputra Plains raises environmental and socio-economic concerns. Mining and extraction activities can lead to environmental degradation, habitat destruction, and pollution, impacting local ecosystems and communities.

Moreover, the equitable distribution of benefits from mineral resource development remains a challenge, with issues of land rights, compensation, and community welfare requiring attention. The Brahmaputra plains' natural beauty and wildlife sanctuaries make it a famous tourist destination.

SAQ I

a) Write a brief note on the physiography of Indo-Ganga and Brahamputra plains.

b) Briefly discuss the rivers of the Indus system draining this region.

c) Briefly discuss the rivers of the Ganga system draining this region.

d) Write a brief note on climate of the Indo-Ganga and Brahamputra plains.

e) Briefly discuss the vegetation found in the Indo-Ganga and Brahamputra plains region.

f) Briefly write about soils of Indo-Ganga and Brahmaputra plains.

9.4 INDO-GANGA PLAIN: THE CULTURAL SETTING

9.4.1 Population

The Indo-Gangetic and Brahmaputra plains are densely populated regions. This region houses a massive proportion of India's total population. People with diverse socio-economic backgrounds have inhabited this region since long back. The existing population pressure affects the region. It represents the heterogeneous composition of people in terms of ethnicity, religion, language, and castes.

The **Indo-Gangetic Plains**, extending from Punjab in the west to West Bengal in the east, covers a vast area in northern India. This region includes many states, such as Punjab, Haryana, Uttar Pradesh, Bihar, and West Bengal. The aggregate population of these states exceeds several hundred millions. Uttar Pradesh and Bihar, two of India's most populous states, together provide a substantial share of this figure. Uttar Pradesh alone has a population above 200 million, while Bihar has over 100 million.

The great plains of Indo-Ganga are among the most densely populated areas, receiving more rainfall with better irrigation facilities. Northern and eastern districts of the region are wetter and richer in sweet and potable underground water than semi-arid south-western districts identified as Rajasthan plains. These, therefore, have always attracted more people to settle there throughout history. Delhi, the capital of the country and one of the largest metropolitan cities in India lies in this vast region. Besides it, Amritsar, Jalandhar, Ludhiana, Jagadhri-Yamunanagar, Chandigarh, Gurugram, Murshidabad, Durgapur, Howrah, and Haldia are critical industrial towns and cities of this region. The region's population is more than 200 million, with the most populous states like Bihar, Uttar Pradesh, and West Bengal in this region.

The **Brahmaputra Plains** are mostly situated in the state of Assam and portions of Arunachal Pradesh in northeastern India. These plains also sustain a dense population, albeit not as high as the Indo-Gangetic lowlands. Assam is the predominant state in this area, with a population above 30 million.

People of varied socio-economic backgrounds have inhabited the Brahmaputra valley. The total population of Brahmaputra plains was 31,205,576 persons in 2011. The plains, accounting for 72 percent of the state’s total area, share 85 percent of the state's total population. 7.05 percent of people of the state belong to Scheduled Castes and 12.45 percent to Scheduled Tribes. Boro is the largest ethno-linguistic group in the state of Assam. The sex ratio of the plains was 958 females per 1000 males in 2011. The female literacy rate in the plains was 66.27 percent, while the male literacy rate was 77.85 percent.

The population density in these plains is one of the greatest in the world, mostly due to the good soil and ample water supplies that support agriculture, which is the mainstay of the region's economy. The high population density offers several prospects as well as difficulties. On one side, it offers an extensive pool of workers and a substantial market for products and services. However, it presents considerable obstacles in terms of achieving sustainable growth, effectively managing resources, and adequately providing services and infrastructure to fulfill the population's demands.

The urban areas in these plains, including Delhi, Kolkata, Lucknow, and Patna, are some of India's most densely populated cities. Each of these cities plays a considerable role in shaping the demographic characteristics of the region. These urban centres allure individuals from rural regions due to the prospects of education, jobs, and healthcare, hence augmenting the area's population density.

The Indo-Ganga and Brahmaputra plains region is mostly rural, with the bulk of its inhabitants involved in agricultural activities, as well as other primary sectors like poultry farming, fisheries, and dairy production. Highest population density areas are middle Ganga and lower Ganga plains in India. Union Territory (UT) of Delhi has highest population density with 11,320 persons per square kilometres. On the other hand, Haryana has the lowest sex ratio. Lowest sex-ratio has also been registered in Haryana of this region. Middle Ganga plain has lowest literacy rate and highest poverty in India.

9.4.2 Settlement

Settlements in the region are mainly clustered/agglomerated because of the high population pressure on these fertile lands. These settlements are mainly found all around the Ganga plains with recognisable house pattern shapes. Semi-clustered or fragmented settlements result from the clustering in a restricted area of dispersed settlement. Hamleted settlements are fragmented into several units physically separated from each other, bearing a familiar name. Middle and lower Ganga plains have such settlement structures. Dispersed settlements arise due to highly fragmented terrain and land resource bases in habitable areas found in the Brahmaputra plains.

This region has a vast rural population because agriculture is the main livelihood activity. Three states of Indo-Ganga plains, namely Uttar Pradesh, Bihar, and West Bengal, have the highest proportion of rural population in India. Though the rural population is dominant, this region also has some million-plus cities and urban agglomeration, which are the main centres of industrial activity and have high population density.

Table 9.1: Urban Agglomeration, 2011

S. No.	Million Plus Cities/Urban Agglomeration, 2011
1	Ludhiana (Municipal Corporation, MC)
2	Amritsar (Urban Agglomeration, UA)
3	Chandigarh (UA)
4	Faridabad (MC)
5	Delhi (UA)

6	Jaipur (MC)
7	Jodhpur (UA)
8	Kota (MC)
9	Kanpur (UA)
10	Lucknow (UA)
11	Ghaziabad (UA)
12	Agra (UA)
13	Varanasi (UA)
14	Meerut (UA)
15	Allahabad (UA)
16	Patna (UA)
17	Kolkata (UA)
18	Asansol (UA)

(Source: Census of India, 2011, Provisional)

The Brahmaputra plains, sprawling across the north-eastern region of India, particularly in Assam, is a vast and fertile landscape characterised by a mosaic of villages, towns, and cities. These settlements serve as centres of culture, commerce, and community life, contributing to the vibrancy and diversity of the Brahmaputra valley. Among the notable settlements in the Brahmaputra plains are:

1. Guwahati: Assam's largest city, Guwahati is a major urban centre on the Brahmaputra plains. Guwahati is located on the southern bank of the Brahmaputra river and acts as the gateway to India's north-eastern region. It is known for its cultural history, historical sites, and colourful market places. Guwahati is a major economic hub with growing industries, businesses, and educational institutions.

2. Dibrugarh: Located in the eastern portion of Assam, Dibrugarh is known for its lush tea gardens. The town is an important centre for the tea industry, with large tea gardens and processing facilities dotting the terrain. Dibrugarh is also a centre of trade and business, aiding the exchange of goods and commodities.

3. Jorhat: Jorhat, another prominent city in Assam, is well-known for its rich cultural history and educational institutions. Jorhat, is home to various historical sites, including Majuli, the world's largest river island, which is located nearby. The town is also a hub for education and research, with prominent universities and research organisations close by.

4. Tezpur: Tezpur, located on the northern bank of the Brahmaputra river, is well-known for its historical significance and scenic beauty. The town is rich in mythology and tradition, with old temples, ruins, and monuments dotting the landscape. Tezpur is also recognised for its gorgeous surroundings, which include lush foliage, rolling hills, and the calm Brahmaputra river.

5. Silchar: Located in southern Assam, Silchar is a significant town and a trade and commerce hub in the Brahmaputra plains. The town is recognised for its vivid markets, busy streets, and ethnic diversity. Silchar serves as a vital transportation centre, connecting the Brahmaputra plains to other regions via road, rail, and aviation lines.

6. Sibsagar (Sivasagar): This historical town is notable as the historical capital of the Ahom Kingdom, which governed the Brahmaputra valley for centuries. Sibsagar is well-known for its ancient temples, palaces, and constructions, which include the spectacular Rang Ghar and Talatal Ghar. The town exemplifies the Ahom dynasty's rich cultural history and architectural legacy.

7. Dhubri: Located in western Assam, Dhubri is a historic and culturally significant town. It is well-known for its historical sites, which include old temples, mosques, and forts that reflect the region's unique cultural past. Dhubri is a trade and commerce hub, with thriving markets and commercial institutions catering to the requirements of the local population.

In addition to their economic and historical significance, the Brahmaputra plains villages are distinguished by a rich cultural tapestry woven by the region's numerous ethnic communities. Each village adds its own customs, traditions, and festivals, which enrich the cultural and social fabric of the Brahmaputra valley. The Brahmaputra plains are a melting pot of cultures, with colorful Bihu celebrations in the Assamese community, traditional dances in the Bodos, and exciting festivals of the Mishing tribe.

The villages of the Brahmaputra plains are the region's heart and soul, acting as cultural, commercial, and community centres. From the busy metropolis of Guwahati to the historic hamlet of Sibsagar, each settlement has its own distinct beauty and significance, adding to the Brahmaputra valley's richness and diversity. The communities of the Brahmaputra plains, with their rich cultural heritage, strong economies, and picturesque landscapes, provide an insight into north-eastern India's distinct personality and spirit.

Settlement patterns in the Indo-Gangetic and Brahmaputra plains exhibit a wide range of diversity due to the region's diversified terrain, cultural history, economic progress, and agricultural methods. The settlement patterns in these plains vary from highly populated metropolitan centres to extensive rural settlements and are shaped by variables such as the presence of water, soil quality, transportation infrastructure, and historical and political events. Below is a summary of the establishment and diverse patterns of settlements in the area:

Types of Settlement Patterns

- **Linear Settlements:** Linear communities in the Indo-Gangetic and Brahmaputra plains are often seen along the riverbanks and roadways, aligning themselves with the natural and man-made characteristics of these areas. These are common in locations where agriculture relies significantly on river water and in areas with well-established road and rail networks that support commerce and communication.
- **Clustered or Nucleated Settlements:** This pattern is widespread in regions characterised by fertile terrain, where inhabitants congregate around water supplies, market places, temples, or other focal locations of social and economic significance. Clustered communities are prevalent in flat areas, especially in agricultural regions where towns are organised around a central square, market place, or significant farmland.

- **Dispersed Settlements:** Dispersed settlements are often located in regions with infertile soil or in steep terrains that are next to flat plains. These towns are characterised by scattered dwellings that are spread out across a wide expanse. This pattern is infrequent in the more fertile portions of the plains but may be seen on the outskirts and in locations where contemporary agricultural methods have not yet completely permeated.
- **Grid Pattern Settlements:** Grid pattern settlements are a common feature of planned urban and rural areas. They are often seen in colonial cities and towns located in flat regions, where streets are arranged in a grid-like manner. This design enables the effective use of land and is often linked to regions that have undergone methodical urban planning.

Urban Settlements

- The area includes many of India's most prominent and historically important cities, including Delhi, Kolkata, Lucknow, and Patna. These cities serve as centres for administrative, economic, and cultural activity, showcasing a combination of ancient traditions and contemporary progress. Urban settlements on the plains have undergone gradual changes over many centuries, resulting in the coexistence of old towns such as Varanasi, which showcase many layers of historical settlements with contemporary urban expansion.

Rural Settlements

- A significant proportion of the populace inhabiting the Indo-Gangetic and Brahmaputra plains mostly lives in rural regions, where their settlements are intricately linked to the agricultural timetable and the monsoon pattern. Rural villages often include farmsteads surrounded by cultivated land, whereby village existence is firmly grounded in agricultural activities, indigenous celebrations, and communal bonds.

The settlement patterns seen in the Indo-Gangetic and Brahmaputra plains provide evidence of the region's rich cultural legacy, economic dynamism, and flexibility to adjust to changing environmental and socio-economic circumstances. Gaining comprehension of these patterns offers a valuable understanding of the historical evolution, present difficulties, and forthcoming possibilities of one of the most vibrant places in India.

This region has a huge rural population due to agriculture being the main livelihood activity. Three states of Ganga plains, namely Uttar Pradesh, Bihar, and West Bengal, have the highest proportion of rural population in India.

9.4.3 Economy

- **Agriculture**

Agricultural Universities in the **Indo-Ganga plain** region from west to east have done excellent work in propagating the cultivation of high-yielding crop varieties and disseminating improved cultivation methods among farmers. Factors like mildly cool winters and hot summers enable this fertile plain to grow crops like wheat, rice, gram, bajra, cotton, sugarcane, and oilseeds as main crops. Intensive cultivation is practiced due to high population pressure.

High yields are obtained by sowing high-yielding varieties of crops and using fertilizers and proper irrigation. In Punjab, wheat is the leading crop of the Rabi season, while rice dominates rest of the plain as main crop.

Wheat is the main crop. It occupies nearly one-third of the total cultivated area. Wheat is dominant crop in Punjab and the eastern districts of Haryana. Gram is cultivated in semi-arid of this region, particularly in south-western part. It is the main Rabi crop and requires less moisture as compared to wheat. Hisar and Sirsa districts of Haryana are main producers of Gram crop in Haryana. **Cotton** is another vital crop mainly grown in relatively dry but canal-irrigated districts. It includes Ferozepur, Faridkot, Bhatinda, Sangrur, Sirsa, Hisar, and Jind etc.

Rice is most important crop during the Kharif season. It occupies more than half of the cultivated area of Great plains. It is grown thrice in a year especially in the Lower Ganga plains. It happens on account of the region's immense water resources and ample amount of rainfall. Rice is a staple crop of this region. Besides, rice is also grown intensively in the plains of Punjab and Haryana state. In these two states, the cultivation of rice depends on irrigation, mainly for export purposes, known for its Basmati variety (long grain).

Agriculture is not only a significant livelihood for the inhabitants of the Brahmaputra plains but also creates the culture and economic backbone of society. The agriculture of the plains is distinguished by the tiny size of landholdings, low-tech farming practices, and less productive subsistence farming. Two types of farming are practiced in the plains: small-scale peasant farming and commercial tea plantation. The agricultural sector engaged 69 percent of total workers in 2021-22. Rice is a staple food and the region's dominant cereal crop. Three types of rice, autumn rice (ahu), winter rice (sali), and summer rice (baro), are grown based on the growing and harvesting season. Other important crops grown include maize, wheat, legumes, oilseeds, and potato. Significant economic crops grown in the region are jute, tea, sugarcane, and tobacco.

- **Dairy**

The whole region follows the process of cattle breeding for their personal needs and livelihood. Rearing cows, buffalo, goats, and sheep are common among these. Cattle and Dairy products are significant in the Punjab-Haryana-Upper Ganga plain. Cattle and buffalo breeding are subsidiary occupations here. The Haryana breed of bulls and the Murrah breed of buffaloes are famous in semi-arid south-western districts. Since buffaloes of the Murrah breed yield relatively large quantities of rich milk, these are sold to dairies in far-off towns, namely Mumbai, Kolkata and Nagpur, etc. Amritsar is the leading center of fresh milk collection, and it supplies milk to Chandigarh and Shimla cities. Modern dairy industries for producing milk products have recently been set up in Amritsar, Ludhiana, and Rohtak districts.

- **Irrigation**

Alluvial plains of Punjab-Haryana have become prosperous because of tube wells and canal irrigation. Other parts of the plains are mainly dependent on rainfall and groundwater. Canals serve areas near rivers. Well, irrigation is

more prominent in districts along Haryana's right bank of the Yamuna Canal. Tube wells are used in Ganga plain if rainfall is insufficient or delayed. Indira Gandhi Canal (IGC) has helped some agricultural activity and brought prosperity and greenery in parts of the Rajasthan plain, which otherwise is a part of desert region.

- **Power**

Hydel power has been developed by taking advantage of favourable conditions. Some of the schemes have been mentioned below:

i) Uhl River Scheme: This scheme was commissioned in 1933. It is done with the help of a storage dam. The storage dam is built across the Uhl stream (a tributary of the Beas river) at Barot situated in the Mandi district of Himachal Pradesh. The powerhouse is situated at Joginder Nagar, 1250 metres above mean sea level.

ii) Bhakra Nangal Project: In order to generate and provide electricity to the north-western parts of India on the one hand and to extend irrigation amenities in the north-western parts of Haryana and the south-western Punjab on the other hand, Bhakra Nangal Project, a multi-purpose scheme of gigantic dimensions was commissioned in this region in 1948. Nangal Dam is constructed to divert the river water to feed the Bhakra Irrigation Canals. This large project helps to irrigate nearly 1456,000 hectares of agricultural land. Besides, it also provides perennial source of water supply.

iii) Beas Project: This is a multi-purpose project. It is made up of two central units. These two are Beas-Sutlej Link and Beas Dam. These are located in a place named Pong in Himachal Pradesh.

a) Beas-Sutlej Link: River Beas incises a deep gorge through the Dhauladhar range at a place named Larji. Just below Larji, the Beas valley becomes narrow, deep, and higher as compared to Sutlej. The stretch of Beas-Sutlej link between the Larji and Mandi district is close to the Sutlej river.

b) Beas Dam: The Beas river keeps on flowing just below a place named Pandoh (along the water storage dam), through a deep and narrow valley before it enters into the plains. From here; its course starts broadening located a few kilometres below the Pong village. This dam was constructed across the Beas river near Pong. It is located about 130 kilometres away downstream from Pandoh.

iv) Rihand Hydroelectric Project: It is the most critical multi-purpose project. The dam has been built near Pipri in the Sonbhadra district of Uttar Pradesh on the Ganga river. Its total installed capacity is 300 Megawatt (MW), the largest artificial lake in India.

v) Khara Hydroelectric Project: It has an installed capacity of 72 MW. It is operated by Uttar Pradesh Jal Vidyut Nigam Limited (UPJVNL).

vi) Sharda Hydroelectric Project: Sharda Barrage on Sharda river (Mahakali river) was built in the 1920s under an agreement signed between British India and Nepal. It is also attached to the Ganga Grid system.

vii) Dagmara Hydroelectric Project: It is located near the village of old Bhaptiyahi on the left bank, about 31 kilometres downstream of Bhimnagar barrage (known as Kosi barrage) on the Kosi river in district Supaul of Bihar. The project is a run-of-river scheme, and 405.46 MW of annual energy is envisaged to be generated from it.

viii) Jaldhaka Hydel Project: This serves as a bridge across Bhutan. Tourists are allowed to visit forest cottages near this.

ix) Purulia Pumped Storage Project: This has four units of 224 MW each. This project can instantly generate 900 MW of power by discharging stored water from the Upper to the Lower dam through a reversible pump turbine and generator motor.

x) Kopili Hydroelectric Project: This 275 MW project is on the Kopili river and its tributary, Umrong stream. It is in the Dima Hasao district of Assam state in India.

- **Industrial Development**

Some large-scale industries have been set up here, including cotton textile, woollen textile, jute, sugar, and associated industries, fertilizers, bicycles, light engineering goods, locomotives, paper, etc. Small-scale industries like sports goods, handlooms, hosieries, glasses, locks, etc., are also found in the region. Ambala is the largest manufacturer of Scientific Apparatus; Amritsar city is famous for its machine tools, textiles, and food processing industries, and Jalandhar is famous for sports goods. The Hosiery industry is centered in Ludhiana, India's chief centre of woollen hosiery goods. Chikankari embroidery is associated with Lucknow, brass work with Moradabad, leather works from Agra and Kanpur, Madhubani painting from Madhubani, petroleum products from Haldia, etc.

The important industries of the region are the light engineering and handloom industries, which are widely spread in this region. Punjab plain is the region's most prosperous area due to the dynamic nature of economic activities.

Industries

Despite enormous potential, the Brahmaputra plains are trailing behind in industrial growth. The plains have various agricultural, mineral, forest, and cattle resources. Numerous types of industries in the valley include agro-based industries, mineral-based industries, forest-based industries, chemical industries, textile industries, and building material industries.

Tea is prominent in the agro-based sector. Other agro-based enterprises in the valley are small and medium-sized cotton and synthetic yarn factories, jute mills, sugar mills, paper mills, vegetable processing mills, food processing mills, and fruit canning factories. Cottage industries of handloom, sericulture, cane products, carpentry, brass and metal crafts, etc., are significant. The plains also have a strong tradition of producing Eri, Muga, and Tassar silk.

It may be noted that tea, oil, natural gas, mineral, and forest-based businesses are predominant in districts of the Upper Brahmaputra plains. Agro-based industries like jute mills, sugar mills, paper mills, etc., are mainly

situated in Nagaon and Morigaon districts. The majority of districts of Lower Brahmaputra plains are industrially backward. Geographical isolation from the rest of India, poor transport and communication facilities, insufficient local markets, shortage of electricity, capital and skilled labour and entrepreneurship and good industrial policies, insurgency problem, lack of land, etc., are mainly responsible for the sluggish growth of business enterprises in the brahamputra plains.

9.4.4 Transport and Communication

Economic development and national growth are linked with efficient transport and communication systems. There are various modes of transportation, namely roadways, railways, airways, and waterways. These are the four pillars of the **Indo-Ganga plains** region.

Roadways

A web of national highways, state highways, expressways, and other roads covers the region. Important national highways are NH 34 from Rishikesh to Haridwar, NH 334A from Haridwar to Laksar, and Purkazi town in Muzaffarnagar district on the Uttarakhand-U.P. border. Grand Trunk route through Delhi-Karnal and Ambala-Ludhiana-Amritsar is extended from the National Road 10 Rohtak, Hisar, Fazilka to the Pakistan border.

Railways

The region has high railway density as it is easier to construct railway tracks in plains, and the area has a high population density. This region has many railway zonal headquarters, namely, Northern Railways-Delhi, North Central Railway-Prayagraj, North Eastern Railway-Gorakhpur, North Western Railway-Jaipur, and East Central Railway-Jaipur. This region has a broad-gauge railway line with passenger, express, superfast, and freight trains. The recent development in the railways is the addition of Vande Bharat Express and the future scheme of bullet train projects.

Airways

Being a densely populated region, the recent development of airway services, combined with increasing purchasing power, has helped air travel penetrate middle-class houses. The region has many international airports, and foreigners visit the heritage offered by this macro-region.

International Airports

Airport Name	State/UT
Gaya International Airport	Bihar
Jay Prakash Narayan Airport	Bihar
Chandigarh International Airport	Chandigarh
Indira Gandhi International Airport	Delhi
Jaipur International Airport	Rajasthan
Chaudhary Charan Singh International Airport	Uttar Pradesh
Lal Bahadur Shastri International Airport	Uttar Pradesh

Waterways

The region has mighty perennial rivers of India, allowing the waterways to operate. The main National waterways of the region are Ganga and Brahmaputra rivers. National waterway one from Prayagraj to Haldia stretch of Ganga-Bhagirathi-Hooghly rivers, NW2 on Sadiya-Dhubri stretch of Brahmaputra River, NW7 on Ajay river, etc.

Transport and communication facilities are critical infrastructures for moving people and services, trading agricultural and other products, and linking production and consumption areas. However, transport and communication systems in the Brahmaputra plains are not very well developed. Means of transport in the Brahmaputra plains include roads, railways, waterways, and airways.

Roads play an essential role in intra-state and inter-regional travel. National highways, state highways, and district roads connect the plains. The development of roads in the plains is far from satisfactory. A considerable number of settlements are still to be connected with metalled roads. Extension of road transport infrastructure to interior settlements is particularly vital for agricultural development. Assam State Transport Corporation (ASTC) has been functioning in the plains under the public sector. Besides, private road transit also plays an essential role in connecting rural sections of the plains with larger centres. National Highways primarily run east-west in Brahmaputra plains and connect all significant municipalities as well as district headquarters.

Inter-state and inter-city passenger trains connect different places of the plains with key places of the state and the country. Railway networks have both metre-gauge and broad-gauge lines. Railway lines connecting the Brahmaputra plains with other parts of the country pass through a narrow corridor in North Bengal.

Brahmaputra river and its numerous tributaries provide potential for developing water transport. It is the No.2 National Waterway with a large number of river ports, such as Guwahati, Goalpara, Dhubri, Nimati, Biswanath, Silghat Dibrugarh, and Dishangmukh. The Directorate of Inland Water Transport (TWT) and Central Inland Water Transport Corporation (CIWTC) operate water transport services between Guwahati and Kolkata exclusively for the movement of goods.

Ferry services available at different ferry ghats of Brahmaputra also transport goods and passengers by water. Many tributaries of Brahmaputra are also navigable by country boats. However, the regularity and upgradation of the water transport system are still quite poor.

Districts of Brahmaputra valley are well connected by air transport with other parts of the country. There are five civil airports in the valley: Borjhar in Guwahati, Salonibari in Tezpur, Rowriah in Jorhat, Mohanbari in Dibrugarh, and Lilabari in Lakhimpur. Indian Airlines and other private commercial airlines, such as Sahara, provide air transport. Air transport is too costly to influence the state's peasant agricultural population directly.

SAQ 2

a) Briefly discuss the types of settlement found in the Indo-Ganga and Brahmaputra plains.

b) Briefly discuss the various modes of transport and communication of Indo-Ganga and Brahmaputra plains.

9.5 INDO-GANGA AND BRAHMAPUTRA PLAINS: THE REGIONS

The Indo-Ganga plain region has been divided into many micro regions. The regions propounded by R.L. Singh have been discussed below.

a) Rajasthan Plains: The Rajasthan plain (24°30'N-30°12'N and 69°15'E-76°45'E) includes the Marusthali and adjoining Bagar to the west of Aravallis extending over western districts of Rajasthan namely, Jaisalmer, Barmer, Jodhpur, Bikaner, Jalore, Nagaur, Ganganagar and Churu alongwith the western portions of Pali, Sikar and Jhunjhunu districts. It covers an area of 1,96,747 square kilometres of Rajasthan. It receives less than 50 centimetres of annual rainfall, with the high temperature reaching above 50°C in summer during the day. There is less economic activity in this area and the settlements are rural.

(**Note:** Rajasthan plains form a part of peninsular India according to the regionalisation scheme devised by other scholar, which you will study in next Unit 10).

b) Punjab Plains: Punjab plain is situated in the north-west at 27°39'N-32°30'N and 73°51'E-77°36'E and constitutes a significant part of the Great plains of India. The region has an area of 95,714 square kilometres and comprises the reconstituted States of Punjab, Haryana and Delhi. The Punjab plain region is physically a distinct unit made up largely of extensive alluvial deposits, culturally a varied region where varied cultures have mingled and transformed after being laid in strata by wave after wave of neo-cultures, primarily emerging from the vast ocean of political and cultural upheavals.

c) Upper Ganga Plain: Upper Ganga plain is a part of the Great plain lying approximately between Yamuna in the west and 100 metre contour in the east. This plain lies between 73°3'E-82°21'E and 25°15'N-30°17'N and covers an area of about 1,49,029 square kilometres. This plain is close to the national capital and has enjoyed greater stability. This part is more developed than middle Ganga plain as it has been in importance since Mughal time to British India.

d) Middle Ganga Plain: Middle Ganga plain is a large physical area lying between 24°30'N-27°50'N and 81°47'E-87°50'N. It has an immense human, cultural and economic significance which makes it the heart region of India. It covers the area of eastern Uttar Pradesh and Bihar. The geographical location of the plain where easterlies and westerlies combine

makes it rich in cultural and economic patterns. The maximum length from east to west is about 600 kilometres while its width from north to south is approximately 330 kilometres.

e) **Lower Ganga Plain:** This plain includes Kishanganj tehsil of Purnea district of Bihar and whole of West Bengal state (excluding the Purulia district and mountainous parts of Darjeeling district). This plain is mainly comprised of delta. The plain lies between 21°25'N-26°50'N and 86°30'E-89°58'E. This plain pre-historically has been the zone of tribal chieftains and is lately Aryanized. The plain has hot and humid climate, with rice and fish being the main food. It is also a culturally rich region and has important place in modern history.

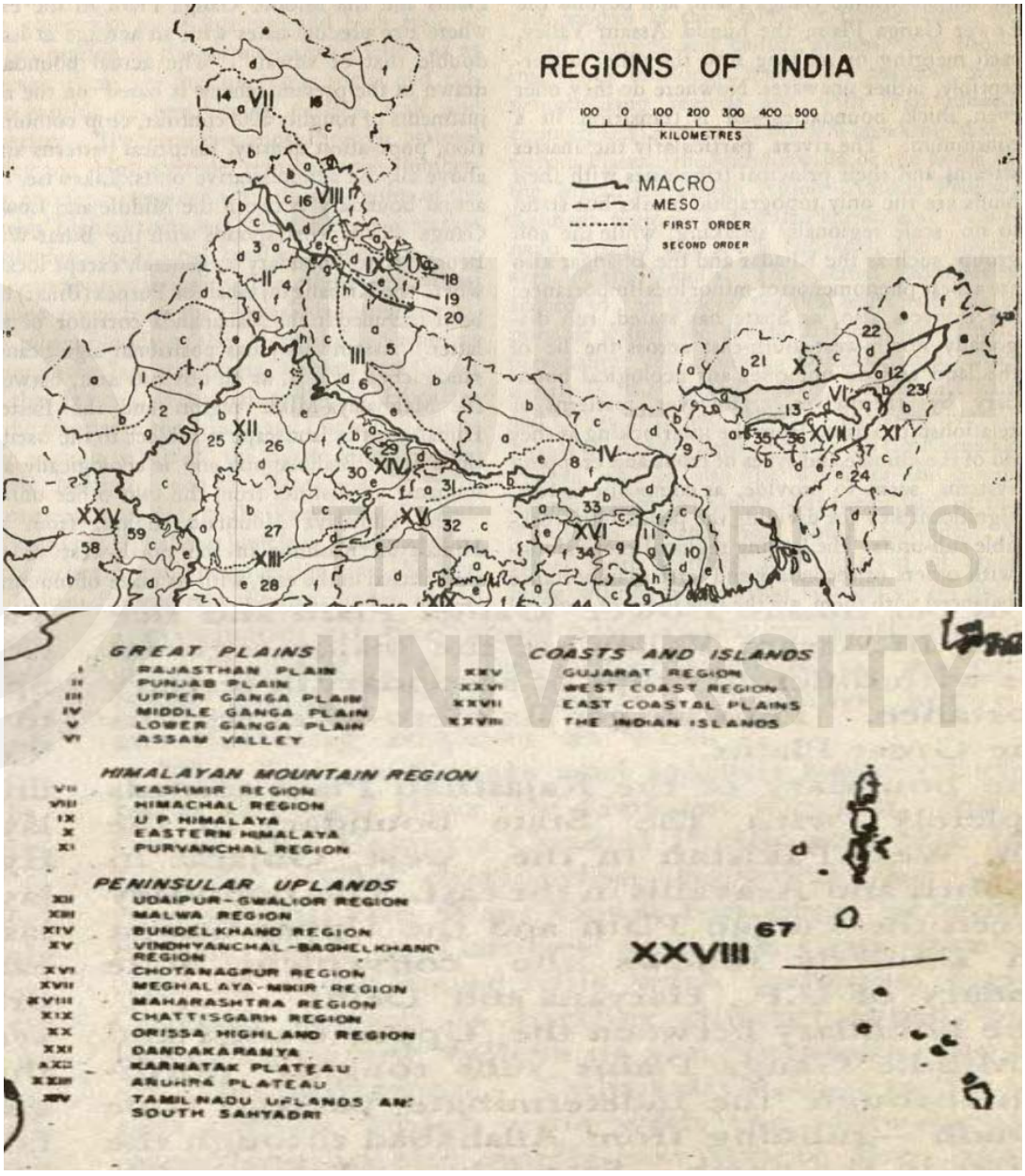

Fig. 9.4: Regions of Indo-Ganga Plains.
(Source: Singh, R.L. ed. (1971). India: A Regional Geography. National Geographical Society of India)

Geographical regions of Brahamputra plain include two divisions as below:

Upper Brahmaputra Plains: It includes districts of Lakhimpur and Sibsagar and significant parts of Tezpur tahsil of Darrang district. In the first place, it is

seen that the significant tea growing area of the plains is confined to this eastern part. This is also important area for mineral oil, commercially exploitable forest resources, and has potential for industrial growth. It is further sub-divided into two parts. These two parts are Upper Brahmaputra plains north and Upper Brahmaputra plains south.

Lower Brahmaputra Plains: It comprises of Goalpara, Kamrup, Nowgong districts and Mangadoi tehsil and western fringe of Tezpur tehsil of Darrang district. The region is basically dominated by agricultural economy with diversified cropping pattern comprising pulses, oilseeds, sugarcane, potatoes, tobacco and jute along with major crop of rice. Recently, wheat has been introduced in relatively drier eastern part of the region. It is further sub-divided into two parts comprising Lower Brahmaputra plains north and Lower Brahmaputra plains south.

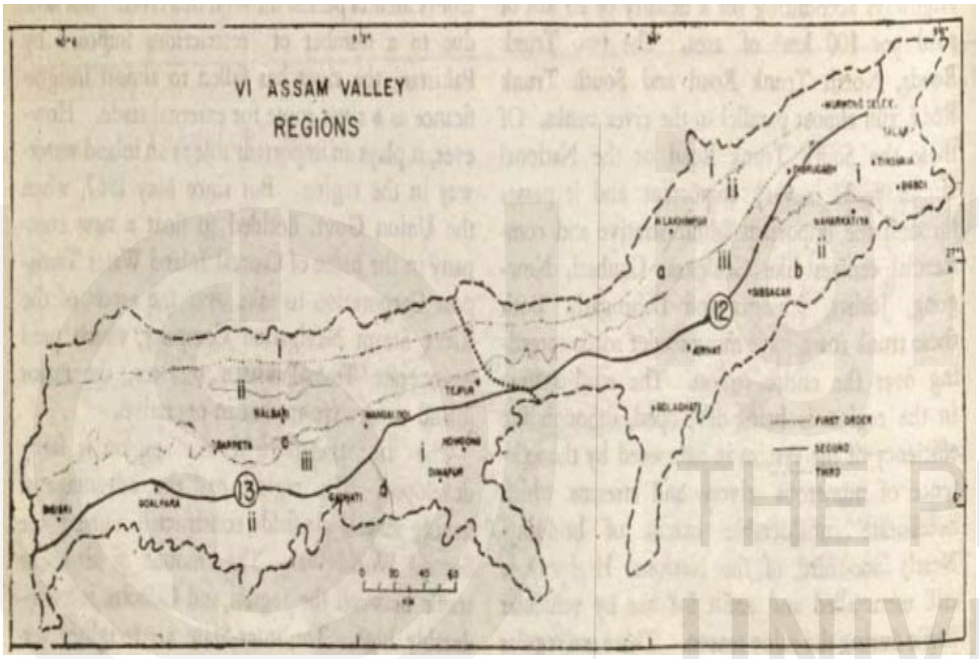

Fig. 9.5: Regions of Brahmaputra Plains.
(Source: Singh, R.L. ed. (1971). *India: A Regional Geography.* National Geographical Society of India)

9.6 INDO-GANGA AND BRAHAMPUTRA PLAINS: PROBLEMS AND PROSPECTS

The Indo-Ganga and Brahmaputra plains region is mostly rural, with the bulk of its inhabitants involved in agricultural activities, as well as other primary sectors like poultry farming, fisheries, and dairy production. The socio-economic challenges encountered by the people are exacerbated by factors such as low literacy rates in the Ganga plains and high levels of poverty. Notwithstanding these obstacles, several areas in the region, such as the Punjab plain, exhibit indications of affluence as a result of vibrant commercial endeavours. The following summarises the issues and future potential of this area as follows:

Problems

a) **Economic Problems:** The region has diverse economic base from agricultural to industrial and to service activities. Ganga and Brahmaputra

plains follow intensive agriculture but with less use of mechanisation and have fragmented lands which poses serious problem for higher yields. Indus plain has high yielding agriculture, but the use of excessive irrigation and fertilizers have completely degraded soil fertility and water logging problem has made some land unsuitable for agriculture. This deterioration of land has high economic impact for the region and the country. Handicraft industry of the region is declining as is the case of glass industry and lock industry etc., which has high economic and cultural impact. Service sector of the region is confined to National Capital Region (NCR) of Delhi causing increase in land rent values and making living difficult for lower income group/category of people. Socio-economic challenges, including poverty, limited access to education and healthcare, and insufficient economic opportunities, compound the complexities of the Brahmaputra plains.

Additionally, conflicts over water resources, especially in the context of Brahmaputra river water being shared among multiple countries, pose diplomatic and geopolitical tensions. Addressing these multifaceted issues requires a comprehensive and collaborative approach involving sustainable land and water management, community engagement, and regional cooperation to build resilience and ensure the well-being of Brahmaputra plains and its inhabitants.

b) **Social Problems:** Society of this region is still intact with its ancient roots. However, sudden westernisation of the society has posed some unnoticeable challenges for the population. Low literacy has been a major contributor in the grave condition of people as they have to do labour as part of livelihood. The caste system has strong dominance in the society even at present, which poses problem for development.

c) **Political Problems:** The region has maximum number of Lok Sabha seats, and this makes it as a perfect spot for all round the year intervention by all political parties. This has some positive consequence also, but the politics has given rise to more and more division of the society in groups and lack of literacy helps in achieving such goals. The region also has problem of anti-social activities and criminals.

d) **Environmental Problems:** As the entire world is facing environmental problems, so is this region. Climate change has impacted rivers of the region resulting in low availability of water and of sudden floods caused by sudden downpours during rainy season. Air pollution, water contamination, and noise pollution are major issues. Industries seem to be major contributor in this respect. Degradation of forest in the area due to high population density is also a problem. The wetlands of the Brahmaputra plains are affected by degeneration and eco-degradation. Factors including rapid eutrophication caused by detritus from floating plants and silt carried by surface runoff, huge, massive human intrusion, misuse of economic resources, including significant fishing, especially during the breeding season, and, most of all, mishandling of wetlands have contributed to the degradation of the wetland ecosystems.

Brahmaputra plains are grappling with a spectrum of challenges that significantly impact the region's environment and the well-being of its inhabitants. Foremost among these challenges is recurrent and devastating flooding during monsoon season, causing widespread damage

to crops, infrastructure, and homes, leading to substantial loss of lives and livelihood. Erosion along the banks of the Brahmaputra river is another critical issue, displacing communities and threatening agricultural lands.

Human activities, including deforestation, unplanned urbanisation, and poor agricultural practices, contribute to land degradation and subsequent decline in soil fertility. Riverbank erosion is a persistent problem, displacing populations and causing the destruction of settlements. Water pollution resulting from industrial discharges, agricultural runoff, and inadequate waste disposal further jeopardises the quality of water and health of the aquatic ecosystems. The region faces biodiversity loss due to habitat destruction, compounded by impacts of climate change, such as altered precipitation patterns and more frequent extreme weather events.

e) **Technological Problems:** Broadly, the region has lack of technological know-how. People have fewer skills for technology, and it has been an obstacle to the region's development.

f) **Water Resource Management and Flooding:** The development of water resources in Indo-Nepal focuses on the fertile plains of Bihar and Uttar Pradesh, which have the potential for high agricultural productivity. However, these areas face challenges in managing water resources, particularly in dealing with the risk of floods caused by the major rivers that originate in Nepal. Similarly, the plains in northern Bihar are exposed to risks such as the fast sideways movement of rivers, frequent floods, and severe erosion of riverbanks. These hazards have a substantial impact on the lives and property of the people living in the area.

g) **Soil Erosion and Sedimentation:** The Garra river basin has significant soil erosion and sedimentation, particularly in the higher mountainous area. This poses difficulties for soil conservation and water management in the region.

h) **Groundwater Depletion:** The excessive use of groundwater for agricultural irrigation has resulted in significant depletion of groundwater levels, which poses a serious risk to food security and the sustainability of rural livelihood. This is due to the unsustainable use of groundwater resources.

Thus, the region is facing several problems as natural resources have diminished in the region along with increasing population pressure. Moreover, uneven distribution of urban centres has also restricted development of the region. Most urban centres are mainly confined to Punjab and Upper Ganga plains while rest of the region is highly rural. To overcome all these challenges, a lot of efforts are undertaken such like:

- An international airport to be developed at Jewar, Uttar Pradesh.
- For improvement in literacy rate, community ownership of government schools, education development, and skill development programmes etc.
- Tourism of the region is being boosted for cultural and economic improvement.

This macro region has certain prospects that carry the potential to usher the region for inclusive development as discussed below:

Prospects

(a) **Hydro-Power Potential:** The North-Eastern area of India, including sections of the Great plains, is recognised as a significant hydro-power zone in the nation. Exploiting this potential has the capacity to make a substantial contribution to India's energy requirements and economic progress.

(b) **Agricultural Productivity:** The Indo-Gangetic and Brahmaputra plains are renowned for their rich soil and exceptional agricultural productivity. By implementing effective water management and adopting sustainable practices, this area can substantially contribute to addressing the issues of poverty and food insecurity in India.

(c) **Flood Plain and Wetland Management:** Efficient flood plains and wetlands management using a watershed strategy may improve agricultural productivity and mitigate flood risks. Additionally, this strategy has the capacity to equalise the allocation of water across places that have excess and those that have insufficient water resources.

SAQ 3

Briefly discuss the major problems and prospects of Indo-Ganga and Brahamputra plains?

9.7 SUMMARY

In this Unit, you have learnt the following:

- The Indo-Ganga and Brahmaputra plains are the largest plains of the world formed by the three mighty rivers rising from the Himalayas.
- The plains are the most fertile alluvial belt in the country and around the world. The region is formed by the collision of two plates namely Indian and Asian.
- It supports the highest population of the country and offers a diverse cultural set-up of the country. The region has importance for Hindus, Buddhists, Jains, Sikhs, and Muslims.
- The region has some famous hydel power projects like Bhakra Nangal, Beas project, Rihand and Dagmara. The region is famous for its floods and also lies in seismic zone.
- The region has sandy to alluvial soils with vegetation from thorny to deciduous to evergreen. The region has all kinds of economic activities and provides cheap labour all around the country. It has a diverse history and the civilisation is as old as Indus Valley Civilisation.
- The region has proper transport network with international connectivity also. The plenty of groundwater and good rainfall supports agriculture of the region but in recent times, the Punjab plains is facing the problem of salinity and water logging in the soil.

- This plain supports the highest population pressure all around the world because of its alluvial base and high fertility, along with plenty of water.
- Large-scale industries such as cotton textile, woollen textile, sugar, and small-scale industries like sports goods, handloom, hosiery, glassware, jute etc., are present in this region.
- This region is divided into micro levels such as the Rajasthan plains, Punjab plain, Upper Ganga plain, Middle Ganga plain, Lower Ganga plain, and Assam valley.
- This plain region is well connected with roadways, railways and air networks.
- This region has a high cultural base and is famous for cultural and historical tourism.
- The region faces the problems of population pressure, low literacy, pollution, hunger, and malnutrition etc.

9.8 TERMINAL QUESTIONS

1. Explain how the soil of the Indo-Ganga and Brahmaputra plains affects the cultural setting of the region.
2. Write a short note on:

   a) Agriculture of Brahmaputra plains
   b) Industries of Indo-Ganga and Brahmaputra plains.
3. Explain the geographical regions of Indo-Ganga and Brahmaputra plains.
4. What are the problems and prospects of the Indo-Ganga and Brahmaputra plains as a macro region?

9.9 ANSWERS

Self-Assessment Questions (SAQ)

1. a) Physiography of Indo-Ganda and Brahamputra plains is characterised by vast expense of fertile land and is divided into Punjab plains, Ganga plains and Brahamputra plains.

   b) Indus river system is made up of six major rivers along with their numerous tributaries. These are Indus, Jhelum, Chenab, Ravi, Beas and Sutluj rivers.

   c) Ganga river system comprises six major rivers and their tributaries. Major rivers are Ganga, Yamuna, Chambal, Gandok, Kosi and Son.

   d) Indo-Ganga and Brahamputra plains are characterised by three types of climatic conditions. These are sub-humid, semi-arid and humid etc.

   e) Indo-Ganga and Brahamputra plains region is known for diverse types of vegetation. Few dominant vegetation types are tropical deciduous forests, grasslands, riparian vegetation and mangroves etc.

f) Indo-Ganga and Brahamputra plains region is known for abundant and fertile soils, i.e., alluvial soil. It is known for high fertility and variable texture.

2. a) The main types are linear, clustered or nucleated, dispersed and grid pattern settlements.

   b) Indo-Ganga and Brahamputra plains are endowed with all the diverse modes of transport and communication to spearhead the region for inclusive development.

3. The major problems are related to the economic, social, political environmental and technological spheres. On the contrary, it also carries vast potential in hydro-power generation, agricultural productivity along with wetland management etc.

Terminal Questions

1. Refer to sub-Sections 9.3.6 and 9.4.
2. a) Refer to sub-Section 9.4.3.
   b) Refer to sub-Section 9.4.3.
3. Refer to Section 9.5.
4. Refer to Section 9.6.

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UNIT 10

MACRO REGIONS OF INDIA 3

Structure

10.1 INTRODUCTION

You have studied about the intricacies of Himalaya and its associated mountain ranges, along with the Indo-Ganga and Brahmaputra plains in Units 8 and 9 of Block 3. In this last Unit of Block 3, you will study about the Indian Peninsula and Islands as meso-region. For better understanding, you will study this unit in two parts - one part will be discussing about peninsula while another one will be based on islands.

Section 10.2 to 10.6 is dealing with the Indian peninsula while Section 10.7 to 10.11 is dealing with the islands. In Section 10.2, you will study briefly about the historical background of Indian peninsula. Section 10.3 delves into

geological and physical facets, exploring rock formations, relief features, drainage patterns, water resources, climate, vegetation, soils, and the overall physical resource base of Indian peninsula. In Section 10.4, you will explore the cultural setting, focusing on population dynamics, settlement patterns, economic landscapes, and transportation networks. You will study about the peninsula as a region in Section 10.5, while Section 10.6 addresses the associated problems and prospects.

Shifting attention to the islands in Section 10.7, you will study about the historical background of the islands. Section 10.8 will be dealing with the islands' structure, examining their geology, physiography, climate, and more. Section 10.9 dives into the cultural setting, mirroring the exploration of the islands, and Section 10.10 discusses the islands as a region, showcasing their unique characteristics. In Section 10.11, you will study about the problems and prospects faced by the people residing in islands.

Expected Learning Outcomes

After studying this Unit, you should be able to:

- examine a brief history of Indian Peninsula and Islands regions;
- understand the nature of physical setting of Indian Peninsula and Islands regions;
- understand the nature of cultural setting in Indian Peninsula and Islands regions;
- explore the regions of Indian Peninsula and Islands; and
- comprehend the problems and prospects of Indian Peninsula and Islands regions.

10.2 INDIAN PENINSULA: HISTORICAL BACKGROUND

Historical background of peninsular India presents a tale of ancient civilisations, maritime trade, colonial encounters, and cultural diversity. Peninsular India's history stretches back to antiquity, with indigenous cultures like the Dravidian civilisation leaving their mark on the region's identity. Ancient dynasties such as Cholas, Cheras, Pandyas, and Rashtrakutas ruled over different territories contributing to the vibrant cultural fabric of the peninsula. Maritime trade routes connected peninsular India with Roman Empire, Southeast Asia, and beyond, fostering cultural exchange and economic growth.

Historical legacy of peninsular India showcases the interplay of cultures, trade, and colonialism. These regions have contributed to India's historical narrative and continue to shape its cultural diversity, environmental richness, and strategic significance. From the perspective of early civilisations of the peninsula, it renders depth and complexity to India's overall historical and cultural heritage.

10.3 INDIAN PENINSULA: THE PHYSICAL SETTINGS

10.3.1 Geology

Geology of Indian peninsula is a testament to the region's complex and diverse geological history. At its core lie ancient Archean cratons, some of the oldest rocks on Earth, forming stable interior of Indian plate. Western Ghats and Eastern Ghats, prominent hill ranges in Indian peninsula, reveal a mix of ancient Precambrian rocks including granite, gneiss, and schist, shaped by millions of years of geological forces. The Deccan plateau, covering a vast expanse of Indian peninsula, showcases extensive basaltic rock formations known as Deccan Traps, which were created during a massive volcanic event. This geological diversity has not only shaped the landscape but also yielded valuable mineral resources and played a crucial role in the region's geological heritage. While the Indian peninsula is relatively less seismically active than some other parts of India, its geology bears testimony to the enduring forces that have shaped its surface over billions of years.

10.3.2 Physiography/Relief

The physiography of peninsular India reflects a diverse landscape shaped by intricate geological processes over millions of years. Indian peninsula, characterised by numerous plateaus, hills, and valleys, is flanked by the Western and Eastern Ghats, contributing to unique topographical and ecological features. Some of the prominent plateaus of peninsular India include - the Marwar upland, the Central highlands (or the Madhya Bharat Pathar), the Bundelkhand upland, the Malwa plateau, the Chotanagpur plateau, the Meghalaya plateau (Shillong plateau), the Deccan plateau, etc.

Indian peninsula region as the largest physiographic division in India, covering around 1.6 million square kilometres, the peninsular upland exhibits high elevations ranging from 600 to over 1,000 metres, with Anamudi in Kerala being the highest peak. The ancient rocks of peninsular India, dating back approximately 3,600 million years, form the Indian shield, showcases evidence of past glacial activity and a geological history shaped by vertical movements, in contrast to the Himalayas' horizontal tectonic origins.

Prof. S. P. Chatterjee, a renowned geographer, conducted a comprehensive study in 1964, dividing peninsular uplands into eight meso-physiographic regions.

Table 10.1: Physiographic Regions of Indian Peninsula

S. No.	Meso Regions
1.	The North Central Highlands
2.	The South Central Highlands
3.	The Chotanagpur Plateau
4.	The Meghalaya-Mikir Uplands
5.	The North Deccan (Maharashtra Plateau)
6.	The South Deccan
7.	The Western Ghats or Sahayadri
8.	The Eastern Ghats

(Source: S.P. Chatterji, 1964, National Atlas Organisation, Kolkata)

1. North Central Highlands

The North Central Highlands also recognised as the **Central Indian Plateau**, bear testament to their complex geological evolution, shaping a diverse landscape over vast stretches of time. The Vindhyan range, spanning from east to west, is characterised by rugged terrain and deep gorges, a result of intricate tectonic activities and erosion dating back to the Precambrian era.

In contrast, the Aravalli range, India's oldest fold mountain range, extends approximately 800 kilometres from southwest to northeast. Its distinct topography, shaped by ancient tectonic movements, is further emphasised by the presence of the Great Boundary Fault, which separates it from the Vindhyan hills. The high elevation of the Aravalli range stands as a testament to the vertical forces that have molded this ancient fold mountain.

Moving westward, the **Malwa Plateau** owes its formation to a combination of sedimentation and tectonic activities. This plateau, with its relatively flat terrain and fertile soil, reflects the geological processes that have unfolded over millions of years. On the eastern front, the **Bundelkhand Plateau** features a rocky terrain characterised by granite and gneiss outcrops, showcasing the enduring impact of geological forces on this region of the North Central Highlands.

The rivers weaving through this plateau, including the Yamuna, Chambal, and Betwa, have played a pivotal role in shaping the physical landscape. The Chambal river, with its erosional forces, has crafted the unique topography of the Chambal ravines, adding another layer to the geological narrative of this region.

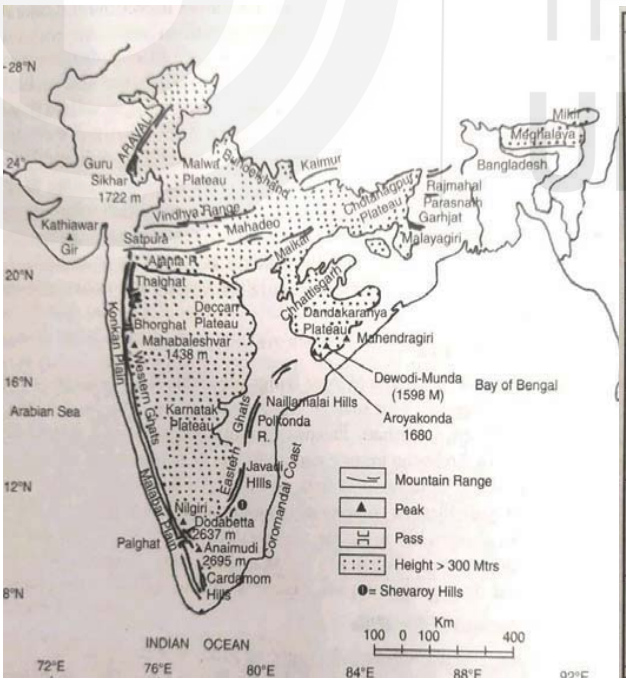


Fig. 10.1: Physiographic Division of India.

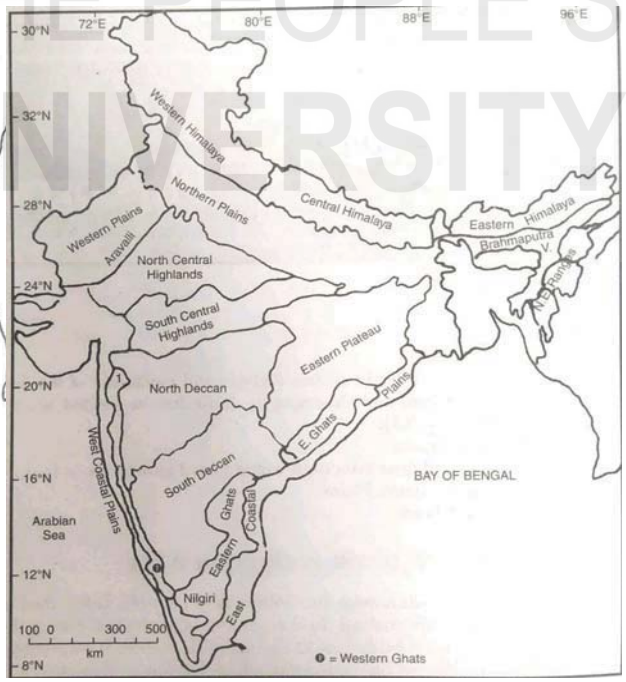


Fig. 10.2: Physiographic Division of Indian Peninsula.

(Source: Geography of India, Majid Hussain, 2013)

2. South Central Highlands

The South-Central highlands of peninsular India are distinguished by their diverse topography. Two prominent sub-regions within this area are the **Bundelkhand (Vindhyachal Plateau)** and **Vindhya-Chambal-Baghelkhand Plateau** which are the results of tectonic activities, including folding and faulting.

Bundelkhand, situated in the northern part of the South Central Highlands (Madhya Pradesh and Uttar Pradesh), is known for its rugged and hilly landscape, adorned with rocky outcrops and plateaus. The topography, influenced by the Vindhya and Satpura hill ranges, is marked by low hills, plateaus, and valleys. Climatically, Bundelkhand experiences a semi-arid climate with hot summers, erratic rainfall, and occasional droughts, posing challenges to agriculture and water resources.

To the south lies the Vindhya-Chambal-Baghelkhand plateau, characterised by a relatively flat landscape with gently rolling hills, expansive plateaus, and fertile plains. The Chambal river and its tributaries traverse this region, contributing to its unique topography. The plateau experiences diverse climatic conditions, ranging from semi-arid to tropical. It receives more consistent monsoon rainfall compared to Bundelkhand thus, fostering agriculture as the primary economic activity of its people. The Chambal river and its tributaries facilitate irrigation, supporting the cultivation of various crops such as wheat, rice, soybeans, and pulses.

3. Chotanagpur Plateau

The Chotanagpur plateau, spanning eastern India, boasts an average elevation of 600 to 700 metres above mean sea level, shaped by geomorphological processes like weathering and erosion. Notable smaller plateaus, including Hazaribagh, Ranchi, Singhbhum, and Palamau, exhibits unique geological formations with ancient rocks like gneiss, schist, and granite.

Renowned as the "**Ruhr of India**", this plateau is rich in mineral resources such as coal, iron-ore, mica, bauxite, limestone, and graphite, contributing significantly to this region's industrialisation. Important rivers, notably the Damodar river, intersect the plateau, with Damodar earning the nickname "Sorrow of Bengal" due to recurrent nature of historical floods.

4. Meghalaya Mikir Uplands

The Meghalaya Mikir uplands, also known as **Meghalaya Plateau**, is a prominent physiographic region in north-eastern India, primarily located within the state of Meghalaya. It has an average elevation ranging from 1,000 to 1,500 metres above mean sea level. Topography of the plateau is marked by rolling hills, deep valleys, and plateau-like tablelands. These landforms have been shaped by erosion, tectonic activity, and the presence of limestone rocks. The plateau is primarily composed of ancient sedimentary rocks, including sandstone, shale, and limestone. It is particularly renowned for its extensive limestone formations, which have given rise to impressive features such as caves, sinkholes, and underground rivers. The region is home to some of the longest caves in the world, including the Mawsmai Caves in Cherrapunji, known for its stunning Karst topographic features like stalactites and stalagmites.

5. North Deccan (Maharashtra Plateau)

The North Deccan, also known as the **Maharashtra Plateau**, is a prominent physiographic region in the Indian peninsula, specifically in the state of Maharashtra. It is a highland region with an average elevation ranging from 600 to 900 metres above mean sea level. It is situated in the northern part of the Deccan plateau. The topography of the plateau consists of gently rolling hills, plateaus, and elevated tablelands. While it is not as rugged as some other similar regions in India, it does feature numerous small valleys and low-lying areas.

Geologically, the plateau is primarily composed of ancient basaltic rock formations, which have resulted from volcanic activity in the distant past. These basaltic formations are collectively known as the Deccan Traps. The presence of these basaltic rock formations has influenced the region's soil composition and has contributed to fertility of the land. The volcanic rock is known for its water retention properties, making it suitable for agriculture.

6. South Deccan

With an average elevation ranging from 600 to 900 metres above mean sea level, South Deccan comprises the **Karnataka Plateau**, **Telangana Plateau**, and **Tamil Nadu Uplands**.

The Karnataka plateau features gently rolling terrain supporting the cultivation of millets, cotton, and oilseeds. Fertile soil and elevated tablelands contribute to its fame for coffee and silk production. In contrast, the Telangana plateau in northern Deccan is characterised by a flat landscape, averaging 300 to 500 metres above mean sea level, intersected by river valleys crucial for the sustenance of agriculture. Crops like rice, sorghum, and cotton thrive, aided by extensive reservoirs and irrigation projects.

The Tamil Nadu uplands, in the southernmost part of the Deccan plateau, showcase diverse topographical features, including rolling hills and steep slopes, bordered by the Western Ghats. Agriculture in this region encompasses the cultivation of rice, sugarcane, tea, and spices, with Nilgiri hills renowned for tea plantations, covering vast areal expanses.

Geologically, the South Deccan is known for diverse rock formations, including basaltic rocks like the Deccan Traps, granite, gneiss, and schist. The Deccan traps, a result of ancient volcanic activity, cover a significant portion of the region and contribute to the fertile soil of the plateau, thus, playing a pivotal role in the regional agriculture and economies.

7. Western Ghats

The Western Ghats, also known as the **Sahyadri**, are a significant physiographic region in western India, which rises abruptly from the Malabar coast and Konkan coast, stretching over 1,600 kilometres parallel to the coastline. Characterised by a unique topography and rich biodiversity, these hills have an average elevation ranging from 900 to 1,600 metres above mean sea level. The Deccan Traps, a massive volcanic feature, prominently contribute to the geological diversity of this region, making the Western Ghats a natural treasure trove fostering rich biodiversity and protecting vital

watersheds. The topography of the Western Ghats comprises a complex network of peaks, valleys, plateaus, and escarpments shaped by geological processes, erosion, and river action. There are several passes and gaps in the western ghats, the most important being **Thal Ghat** and **Bhor Ghat** situated to the east of Mumbai, and **Palghat** to south of the **Nilgiri Hills**. The ghats are broken in the northern part by the Narmada and Tapi rivers resulting into the formation of rift valleys.

8. Eastern Ghats

The Eastern Ghats, a prominent physiographic region in eastern India, exhibit diverse rock formations, including ancient Precambrian rocks, granite, gneiss, schist, and sedimentary layers. Unlike the volcanic history of the Western Ghats, the Eastern Ghats have a more varied geological composition.

Forming an essential part of the Indian peninsula's topography, the Eastern Ghats stretch parallel to the Bay of Bengal, with an average elevation ranging from 600 to 900 metres above mean sea level. The region's topography includes a series of hills, plateaus, and valleys, characterised by a more subdued landscape compared to the steep escarpments of the Western Ghats.

Stretching along India's eastern coast, the Eastern Ghats encompass various noteworthy ghats and physical landscapes. Simlipal hills in Odisha showcases rich biodiversity within Simlipal National Park, while Araku valley in Andhra Pradesh offers stunning scenery and coffee plantations. Papi hills, straddling the twin states of Andhra Pradesh and Telangana, features striking gorges and serene river settings. Tamil Nadu's Shevaroy hills provide an escape with orange groves and trekking opportunities, and Javadi hills offer picturesque landscapes and bird-watching. Kondapalli hills houses a historic fort, and Sri Venkateswara Wildlife Sanctuary near Tirupati is known for diverse wildlife. Lastly, Koraput valley in Odisha combines tribal culture with scenic beauty, contributing to the region's ecological and cultural significance.

10.3.3 Drainage and Water Resources

The Indian peninsula's drainage system and water resources are intricately tied to its diverse geographical features, including the Western and Eastern ghats, the Deccan plateau, the Eastern Coastal plains, and the influence of the monsoon climate. These elements collectively shape the hydrological patterns and the socio-economic fabric of the region. Monsoon rains are the primary source of water for the Indian peninsula's rivers, leading to seasonal variations in river flow. However, the dependence on monsoon rains also makes the region vulnerable to fluctuations in rainfall patterns, which can lead to droughts or floods.

The Western Ghats, running parallel to the western coast, creates a prominent orographic barrier that influences both the climate and the drainage system in the region. These mountains, with their steep western slopes and gentler eastern slopes, play a crucial role in capturing moisture-laden monsoon winds, leading to heavy rainfall on their western side. This orographic effect causes most rivers originating here to flow eastward due to the significant elevation gradient. The major rivers, such as the Godavari, Krishna, and Tungabhadra, begin in the Western Ghats and traverse the relatively flat Deccan plateau,

creating extensive river systems. These rivers flow toward the east direction and drains into the Bay of Bengal. They support agriculture, provide drinking water, and facilitate hydroelectric power generation in the region.

The Eastern Ghats, which are less continuous and lower in elevation compared to the Western Ghats, influence the drainage system in a different way. They are intersected by several significant rivers that cut through these mountains as they flow towards the Bay of Bengal. The Eastern Ghats' discontinuous nature allows rivers like the Mahanadi, Godavari, and Krishna to form wide and fertile deltas in the coastal plains. These deltas are among the most agriculturally productive regions in India, supporting the cultivation of rice, pulses, and other crops.

Unlike river Mahanadi, Godavri and Krishna; river Narmada and Tapi flow westward into the Arabian sea. The Narmada river originates from the Amarkantak plateau in Madhya Pradesh and flows through a rift valley between the Vindhya and Satpura ranges, directing it towards west. Similarly, the Tapi river originates in the Satpura range and flows westward through a parallel rift valley. In contrast, the Penner and Palar rivers flow eastward into the Bay of Bengal. The Penner river originates in the Nandi hills in Karnataka and flows through the states of Karnataka and Andhra Pradesh, following the eastward slope of the Deccan plateau and Eastern Coastal plains. The Palar river also originates in the Nandi Hills and flows through the three states of Karnataka, Tamil Nadu, and Andhra Pradesh, directed eastward by the land's physical gradient.

Indian peninsula has also witnessed the construction of many important dams, reservoirs and multipurpose hydro projects like the Nagarjuna Sagar Dam on the Krishna river, the Mettur Dam on the Kaveri river, and the Hirakud Dam on the Mahanadi river, etc. These reservoirs serve multiple purposes, including irrigation, drinking water supply, and hydroelectric power generation in this region.

10.3.4 Climate

Climate of peninsular India, which encompasses vast and diverse geographical area, is marked by distinct seasonal pattern and varying weather conditions. Majority of this area experiences tropical monsoon climate characterised by two prominent seasons: the wet monsoon season and dry season.

During southwest monsoon, which typically arrives in June and extends until September, peninsular India witnesses a dramatic shift in weather. This season is marked by arrival of moisture-laden winds from the southwest, originating from the Arabian sea. These winds bring copious amounts of rainfall to the region, resulting in heavy, frequent downpours. Southwestern coast, notably Kerala and parts of Karnataka, often receive some of the highest annual rainfall totals in India during this period. Western Ghats play a crucial role in intercepting these moisture-laden winds, causing them to rise and cool, which in turn leads to substantial rainfall on windward side (western slopes) of the ghats. Conversely, the northeast monsoon, which occurs from October to December, primarily affects the southeastern coast of peninsular India, including Tamil Nadu and Andhra Pradesh. During this season, winds

blow from the northeast. These winds bring a secondary rainy period to the region, with its own distinct weather pattern. While the northeastern monsoon is generally less intense compared to its southwestern counterpart, it is essential for replenishing water resources in these coastal areas.

Odisha, located on the eastern coast, receives significant monsoon rainfall from the Bay of Bengal branch. The Chotanagpur plateau, spanning Jharkhand, Bihar, Chhattisgarh, and West Bengal, also relies on the Bay of Bengal monsoon for precipitation. Meghalaya in the northeast receives some of the world's highest rainfall, primarily from the Bay of Bengal branch of Monsoon.

Summer season, extending from March to June, is characterised by sweltering heat, particularly in the interior regions of Deccan plateau. Maximum temperatures can soar above 40°C, and this period experiences low humidity levels. Coastal areas and Western Ghats, on the other hand, enjoy more moderate climate during summer, with temperatures ranging from 25°C to 35°C. However, in winter, which lasts from November to February, offers respite from scorching heat of summer. Maximum temperatures during this season range from 20°C to 30°C, with cooler nights occasionally recording temperature below 10°C in some portions of interior areas. Winter months are generally dry, marked by lower humidity and clear skies.

The climate in peninsular India is also influenced by cyclones, with coastal regions along the Bay of Bengal, such as Andhra Pradesh and Odisha, being particularly vulnerable. Cyclones during the northeast monsoon season can bring heavy rainfall and strong winds, posing significant challenges for disaster management and infrastructure resilience. Furthermore, peninsular India's climate is not static; it is influenced by both natural phenomena and human-induced factors. Climate variability, driven by events like El Niño and La Niña, can disrupt monsoon patterns and lead to irregular weather conditions. Additionally, climate change is contributing to increased variability, with more intense rainfall and prolonged dry spells affecting the region's agriculture, water resources, and overall socio-economic dynamics.

10.3.5 Vegetation

The peninsular part of India is a botanical wonderland, showcasing an extensive array of vegetation shaped by diverse topography, climatic variations, and ecological diversity. The Western Ghats, forming a natural barrier along the western coast, emerges as a hotspot for biodiversity. The evergreen and semi-evergreen forests on the windward side of these mountains benefit from the heavy rainfall brought by the southwest monsoon. Towering trees, including Rosewood, Teak, and Ebony, create a lush canopy, while the forest floor is adorned with a rich tapestry of ferns, orchids, and mosses. In the higher elevations, the unique Shola forests, interspersed with grassy meadows, harbour endemic species like the Nilgiri tree fern, contributing to the region's ecological distinctiveness.

Transitioning towards the interior, the Deccan plateau offers a mosaic of habitats. Dry deciduous forests dominate, showcasing species like Teak, Sal, Neem, and Bamboo. These deciduous landscapes adapt to the seasonal rhythm of the climate, shedding leaves during the dry season. As one moves

farther inland, the vegetation transforms to thorn scrub, where hardy flora such as acacias and euphorbias thrive in arid conditions. The open grasslands, a feature of the more rain-shadowed areas of the Deccan plateau, add to the overall biodiversity, providing habitat for various herbivores and avian species.

The Eastern Ghats, though less prominent, contribute significantly to the botanical diversity of the peninsular region. Mixed deciduous forests, characterised by a blend of Teak, Bamboo, and Terminalia species, thrive in these hills. Areas receiving higher rainfall are adorned with dry evergreen forests, resembling their counterparts in the Western Ghats. The Eastern Ghats, like the Western Ghats, contribute to the creation of a biodiversity hotspot, housing several endemic plant species.

Peninsular coastal areas also exhibit a unique and diverse array of vegetation, intricately adapted to the dynamic conditions of estuarine environments, sandy shorelines, and saline sub-strates. Mangrove ecosystems, with species like Rhizophora and Avicennia, thrive in the intertidal zones, forming dense forests that play a pivotal role in shoreline stabilisation and serve as essential nurseries for marine life. Salt marshes, characterised by halophytic vegetation such as Spartina alterniflora and Salicornia, contribute to sediment stabilisation and provide habitat for various coastal organisms. Coastal dunes, anchored by plants like Casuarina equisetifolia and beach morning glory (Ipomoea pes-caprae), are crucial in preventing erosion and fostering biodiversity. Halophytic plants, including Suaeda and Aeluropus, thrive in areas directly influenced by seawater, contributing to soil health and ecological balance.

10.3.6 Soils

The peninsular part of India is characterised by a fascinating array of soils, shaped by the complex interplay of geological processes, topography, and climate. One of the prominent soil types in this region is the black soil, also known as *“regur”*, which dominates the vast expanses of the Deccan plateau. Renowned for its black color, this soil is a result of weathering of basaltic rocks. Rich in minerals like iron, aluminum, calcium, and magnesium, black soil exhibits a unique ability to swell when wet and form deep cracks when dry, making it ideal for cultivation during the monsoon season. Its exceptional fertility, particularly in regions of Maharashtra, Madhya Pradesh, Gujarat, and Karnataka, has made it a crucial contributor to India's agricultural productivity, particularly for genetically modified cash crops like cotton.

Moving eastwards, the Deccan plateau transitions into regions characterised by red soil, spanning across Karnataka, Andhra Pradesh, Telangana, and Tamil Nadu. The reddish hue of this soil results from the high iron oxide content. While red soil is generally well-drained, its fertility is often compromised due to leaching of minerals. It is best suited for crops like millets, pulses, and groundnuts. However, the vulnerability of red soil to erosion requires careful soil conservation measures to sustain agricultural productivity.

In the western coastal plains and the Western Ghats, laterite soils dominate the physical landscape. These soils are formed through intense weathering in hot and humid conditions, resulting in a characteristic red color. Rich in iron

and aluminum oxides, laterite soils often lack fertility and moisture-retaining capacity. As a result, agricultural practices in these areas may necessitate additional inputs and management strategies.

In the western part of the peninsula covering western Rajasthan and parts of Gujarat, the arid and desert Soils prevail, which are characterised by sandy compositions and a scarcity of organic matter, rendering them inhospitable for most crops. Agriculture in these challenging regions necessitates the cultivation of drought-resistant crops such as millets, barley, and robust vegetables, given the limited water resources and harsh climatic conditions.

Transitioning to higher elevations in the Western Ghats and Eastern Ghats, Mountain soils pose unique challenges with their shallow, rocky, and acidic nature. While less amenable to traditional farming, these soils find utility in horticulture and the cultivation of lucrative cash crops like tea, coffee, and various spices. The undulating topography of these regions and water introduces the constant threat of soil erosion, requiring meticulous integrated land and water management practices.

In coastal areas, saline and alkaline soils are prevalent, especially in regions susceptible to seawater intrusion. Notable for their elevated salt content, making them unsuitable for conventional crop cultivation, these soils demand extensive reclamation efforts. Techniques such as leaching and the incorporation of organic matter are crucial for making them cultivable. Coastal agriculture here primarily centres around salt-tolerant crops and aquaculture, emphasising the importance of overcoming the persistent challenge of seawater intrusion for sustainable land use and agricultural viability.

10.3.7 Physical Resource Base

The peninsular part of India boasts a diverse and resource-rich landscape, characterised by a myriad of physical features that include minerals, hydroelectric power potential, and unique flora and fauna. This region, shaped by its distinct physiography, plays a crucial role in contributing to India's natural wealth.

The distribution of minerals is closely linked to the geological processes that have shaped the peninsular landscape over millions of years. The Deccan plateau, a prominent feature of the peninsular region, is rich in basaltic rocks and hosts significant mineral deposits. Karnataka's Bellary-Hospet region, situated on the Deccan plateau, is a prime location for iron-ore extraction due to the occurrence of extensive hematite deposits. Similarly, the geological formations in Andhra Pradesh favour the accumulation of limestone, contributing to the spatial distribution of this mineral. The Western Ghats, an elevated mountain range running parallel to the western coast, also influences the distribution of minerals. Maharashtra's Nagpur-Bhandara region, located at the eastern edge of the Western Ghats, contains valuable coal and manganese reserves.

The peninsular region is also endowed with a notable hydroelectric power potential, particularly due to its unique topography, with the Western Ghats being a primary contributor. States like Kerala, Karnataka, and Tamil Nadu have harnessed the power of cascading rivers for electricity generation. The

Sharavathi Hydroelectric Project in Karnataka and the Idukki Dam in Kerala are prime examples of utilising the region's geographical resources, particularly hydrological potential features for sustainable energy production. The Western Ghats, with its extensive river systems, presents ample opportunities for the development of hydroelectric projects, contributing significantly to regions' energy needs.

SAQ 1

What are the eight physiographic regions of Indian peninsula according to Prof. S. P. Chatterjee?

SAQ 2

Fill in the blanks of the following:

i. _____ separates Aravali range to Vindhyan hills.

ii. Bundelkhand, situated in the _____ part of the South Central Highlands.

iii. Meghalaya-Mikir uplands is renowned for its extensive _____, which have given rise to impressive features such as caves, sinkholes, and underground rivers.

iv. South Deccan comprises of Karnataka plateau, Telangana plateau, and _____.

SAQ 3

Mark the statement as True or False.

i. During southwest monsoon, which typically arrives in June and extends until September, peninsular India witnesses a dramatic shift in weather.

ii. The open grasslands is a feature of the more rain-shadowed areas of the Deccan plateau.

iii. In the western coastal plains and the Western Ghats, red soils dominate the physical landscape.

iv. The Sharavathi Hydroelectric Project is situated in Karnataka while the Idukki Dam situated in Tamil Nadu.

v. The Southeast monsoon, which occurs from October to December, primarily affects the southeastern coast of peninsular India.

10.4 INDIAN PENINSULA: THE CULTURAL SETTING

Cultural setting of Indian peninsula and surrounding islands is a tapestry interwoven with diverse traditions, languages, religions and lifestyles those have evolved over millennia. This vast region, encompassing peninsular India and the scattered archipelagos, bears testimony to the confluence of historical, geographical, and socio-economic influences those have shaped the rich mosaic

of cultures found here. From ancient civilisations and indigenous communities to modern urban centres and coastal villages, the cultural landscape reflects complexity and vibrancy of people who call these lands as their home.

10.4.1 Population

The Indian peninsula exhibits a diverse demographic landscape characterised by unique cultural, linguistic, and socio-economic attributes. Linguistically, each state has its own official language, contributing to the rich tapestry of Tamil, Kannada, Telugu, Malayalam, Marathi, and Konkani spoken across the region. Religious diversity is another key feature, with Hinduism being predominant, complemented by significant Muslim and Christian populations in states like Kerala, Goa, Telangana, and parts of Andhra Pradesh.

This region's rich cultural tapestry spans southern and southeastern states, showcasing a mosaic of ethnic groups, languages, and traditions. Tamil Nadu is renowned for classical arts, Dravidian architecture, and Bharatanatyam. Karnataka stands out for Carnatic music and traditional crafts, while Andhra Pradesh and Telangana boast vibrant Telugu culture and distinctive cuisines. Kerala, known as "God's Own Country," offers unique cultural blends with boat races, Kathakali dances, and globally popular cuisine. Parts of Goa and Maharashtra reflect fusion with influences from Marathi, Konkani, and Portuguese heritage, showcasing picturesque beaches, vibrant nightlife, and diverse festivals.

Table 10.2 shows the demographic characteristics of the Indian peninsula which reflect the impact of geographical features and locations on the demography of different states.

Table 10.2: Population Characteristics of Indian Peninsular States

S. NO.	Name	Total Population	Population Density	Sex Ratio	Literacy Rate		
					Total	Male	Female
1	Rajasthan	68548437	200.29	928.17	66.11	79.19	52.12
2	Manipur	2570390	115.12	992.29	79.21	86.06	72.37
3	West Bengal	91276115	1028.44	949.97	76.26	81.69	70.54
4	Jharkhand	32988134	413.82	948.47	66.41	76.84	55.42
5	Odisha	41974218	269.57	978.78	72.87	81.59	64.01
6	Chhattisgarh	25545198	188.95	990.60	70.28	80.27	60.24
7	Madhya Pradesh	72626809	235.61	930.93	69.32	78.73	59.24
8	Gujarat	60439692	307.98	919.25	78.03	85.75	69.68
9	Maharashtra	112374333	365.19	929.40	82.34	88.38	75.87
10	Andhra Pradesh	84580777	307.52	992.85	67.02	74.88	59.15
11	Karnataka	61095297	318.55	972.94	75.36	82.47	68.08
12	Goa	1458545	393.99	973.30	88.70	92.65	84.66
13	Kerala	33406061	859.83	1084.31	94.00	96.11	92.07
14	Tamil Nadu	72147030	554.72	996.43	80.09	86.77	73.44

(Source: Census of India, 2011)

(**Note:** The state of Telangana has not been included due to non-availability of Census 2011 data as it was formed on June, 2014).

Table 10.2 presents key demographic indicators for the states of peninsular India, revealing significant variations across population size, density, sex ratio, and literacy rates which are influenced by geographical, socio-

economic, and cultural factors. It shows that Rajasthan with its vast desert landscapes and arid climate has a population of 68,548,437 and population density of 200.29 persons per square kilometres. The state's sparse population is influenced by its extensive desert regions and scarce water resources. The sex ratio stands at 928.17 females per 1000 males, and the literacy rate is 66.11 percent, with a notable disparity between male (79.19 percent) and female (52.12 percent) literacy rates, reflecting challenges in educational access and gender equality in this harsh environment.

Manipur, situated in the north-eastern region and characterised by its hilly terrain and dense forests, has a smaller population of 2,570,390 and a low population density of 115.12 persons per square kilometres. The state benefits from its relatively balanced sex ratio of 992.29 females per 1000 males and a high literacy rate of 79.21 percent, with male literacy at 86.06 percent and female literacy at 72.37 percent, indicating effective educational outreach despite geographical challenges.

West Bengal, located in the fertile Ganges delta with its extensive river networks and lush plains, is one of the most densely populated states with a population of 91,276,115 and a density of 1028.44 persons per square kilometres. The state's rich alluvial soil supports high population densities, while the sex ratio of 949.97 and literacy rate of 76.26 percent, with male literacy at 81.69 percent and female literacy at 70.54 percent, and show substantial educational progress but also a significant gender gap.

Jharkhand, known for its hilly terrain and abundant mineral resources, has a population of 32,988,134 and a population density of 413.82 persons per square kilometres. The state's rugged landscape and extensive forest cover contribute to its population distribution. The sex ratio is 948.47 females per 1000 males, and the literacy rate is 66.41 percent, with male literacy at 76.84 percent and female literacy at 55.42 percent, highlighting the need for improved educational infrastructure in this resource-rich but geographically challenging region.

Odisha, with its diverse geography including coastal plains, river valleys, and the Eastern Ghats, has a population of 41,974,218 and a population density of 269.57 persons per square kilometres. The state's coastal and hilly terrain influences its demographic distribution. The sex ratio is 978.78 females per 1000 males, and the literacy rate is 72.87 percent, with male literacy at 81.59 percent and female literacy at 64.01 percent, indicating progress but also a need for targeted educational improvements.

Chhattisgarh, marked by dense forests and tribal regions, has a population of 25,545,198 and a low population density of 188.95 persons per square kilometres. The state's forest cover and tribal settlements shape its demographic patterns. The sex ratio is 990.60 females per 1000 males, and the literacy rate is 70.28 percent, with male literacy at 80.27 percent and female literacy at 60.24 percent, reflecting the challenges of reaching remote and rural populations with educational resources.

Madhya Pradesh, characterised by its central plateau, extensive forests, and the Satpura and Vindhya ranges, has a population of 72,626,809 and a population density of 235.61 persons per square kilometres. The varied

topography affects population distribution. The sex ratio is 930.93 females per 1000 males, and the literacy rate is 69.32 percent, with male literacy at 78.73 percent and female literacy at 59.24 percent, highlighting significant regional and gender disparities in education.

Gujarat, with its diverse landscapes including coastal areas, arid regions, and river valleys, has a population of 60,439,692 and a population density of 307.98 persons per square kilometres. The state's varied geography affects population density and distribution. The sex ratio is 919.25 females per 1000 males, and the literacy rate is 78.03 percent, with male literacy at 85.75 percent and female literacy at 69.68 percent, showing progress in education but with noticeable gender disparities.

Maharashtra, featuring a range of physical features from coastal plains to the Western Ghats, has a population of 112,374,333 and a population density of 365.19 persons per square kilometres. The state's varied geography supports diverse population densities. The sex ratio is 929.40 females per 1000 males, and the literacy rate is 82.34 percent, with male literacy at 88.38 percent and female literacy at 75.87 percent, reflecting relatively balanced educational attainment across its diverse regions.

Andhra Pradesh, with its coastal areas, river deltas, and the Deccan plateau, has a population of 84,580,777 and a population density of 307.52 persons per square kilometres. The state's geography influences its population distribution. The sex ratio is 992.85 females per 1000 males, and the literacy rate is 67.02 percent, with male literacy at 74.88 percent and female literacy at 59.15 percent, indicating a need for improved educational outreach, particularly for women.

Karnataka, known for its diverse physical features including the Western Ghats, Deccan Plateau, and coastal regions, has a population of 61,095,297 and a population density of 318.55 persons per square kilometres. The state's varied terrain impacts population distribution. The sex ratio is 972.94 females per 1000 males, and the literacy rate is 75.36 percent, with male literacy at 82.47 percent and female literacy at 68.08 percent, highlighting gender disparities in education.

Goa, with its coastal and hilly terrain, has a small population of 1,458,545 and a high population density of 393.99 persons per square kilometres. The state's favourable geographic conditions contribute to its high literacy rate of 88.70 percent, with male literacy at 92.65 percent and female literacy at 84.66 percent, reflecting strong educational attainment with minimal gender disparity.

Kerala, located in the southwestern coastal region with its backwaters and lush green landscape, has a population of 33,406,061 and a high population density of 859.83 persons per square kilometres. The state's favourable climate and geography support high population densities and excellent educational outcomes. The sex ratio is the highest among states at 1084.31 females per 1000 males, and the literacy rate is exceptionally high at 94.00 percent, with male literacy at 96.11 percent and female literacy at 92.07 percent, showcasing exemplary educational attainment and gender balance.

Tamil Nadu, with its coastal plains and inland hills, has a population of 72,147,030 and a high population density of 554.72 persons per square

kilometres. The state's geography influences its demographic patterns. The sex ratio is balanced at 996.43 females per 1000 males, and the literacy rate is 80.09 percent, with male literacy at 86.77 percent and female literacy at 73.44 percent, reflecting relatively high educational attainment but with some gender disparity.

10.4.2 Settlement

The settlement pattern in the Indian Peninsular states is shaped by geography, climate, and economic activities. Rural settlements are mostly compact and nucleated, especially in fertile river valleys like the Krishna-Godavari basin (Andhra Pradesh) and the Kaveri basin (Tamil Nadu), where agriculture is the main occupation. In plateau regions like Karnataka and Maharashtra, settlements are more scattered due to uneven availability of fertile land and less water availability. Urban settlements are concentrated in major cities such as Mumbai, Chennai, Bengaluru, Hyderabad, and Pune, which serve as economic and administrative centres. Coastal settlements in Kerala, Goa, and Karnataka follow a linear pattern along the shore, relying on fishing and trade. In contrast, hilly and tribal settlements in the Western and Eastern Ghats are more isolated, with communities depending on forest resources and shifting agriculture.

The morphology of settlements varies across different regions. Linear settlements are common along rivers, roads, and coastal areas, especially in Maharashtra, Karnataka and Kerala, Tamil Nadu and Andhra Pradesh. Clustered settlements are found in fertile plains, particularly in Tamil Nadu and Telangana, where people live close together for easy access to farmland and water. Scattered settlements are typical in plateau and forested regions, such as in Chhattisgarh and Madhya Pradesh, where people live in small, separate homes spread across large areas. In cities, settlement structures vary from old historical centres to modern planned residential zones and industrial hubs. Coastal cities like Mumbai and Chennai have port-based layouts, while inland cities Bengaluru, Nagpur, Hyderabad, etc., often follow a grid or circular pattern.

The Indian peninsula exhibits diverse settlement patterns shaped by geographical, historical, and cultural factors. Nationally, India has a vast rural landscape with 5,97,608 inhabited villages and a rural population density of 279 persons per square kilometres, contrasting sharply with urban areas where there are no villages but 7,933 towns, and the population density soars to 3,685 persons per square kilometres.

State-specific data reveals significant variations. Rajasthan, for example, has a lower rural density of 153 persons per square kilometres and 297 towns with an urban density of 2,570 persons per square kilometres. Meghalaya's rural population density is one of the lowest at 107 persons per square kilometres, while its urban areas have a density of 2,105 persons per square kilometres.

In contrast, West Bengal stands out with a high rural density of 744 persons per square kilometres and an extremely high urban density of 5,676 persons per square kilometres, reflecting intense urbanisation. Jharkhand and Odisha show moderate rural densities (324 and 230 persons per square kilometres, respectively), but their urban densities are much higher, with Jharkhand at 3,273 and Odisha at 2,090 persons per square kilometres. Chhattisgarh, with

a rural density of 149 persons per square kilometres, shows one of the lowest population densities, indicating a more dispersed rural population.

Madhya Pradesh and Gujarat have similar rural densities (175 and 184 persons per square kilometres, respectively), but Gujarat's urban density (3,477 persons per square kilometres) is higher than that of Madhya Pradesh (2,591 persons per square kilometres). Maharashtra and Andhra Pradesh both exhibit high urban densities (5,588 and 3,593 persons per square kilometres, respectively), signifying substantial urban populations. Karnataka, with a rural density of 202 persons per square kilometres, has an urban density of 3,928 persons per square kilometres, reflecting significant urbanisation.

Table 10.3: Rural and Urban Settlements in the Peninsular India

S. No.	Name	Rural/ Urban	Number of Villages		Number of Towns	Number of Households	Population (per sq. kms)
			Inhabited	Uninhabited			
	India	Rural	5,97,608	43,324	0	16,86,12,897	279
		Urban	0	0	7,933	8,08,88,766	3,685
1	Rajasthan	Rural	43,264	1,408	0	94,94,903	153
		Urban	0	0	297	32,16,243	2,570
2	Meghalaya	Rural	6,459	380	0	4,30,573	107
		Urban	0	0	22	1,17,486	2,105
3	West Bengal	Rural	37,469	2,734	0	1,38,13,165	744
		Urban	0	0	909	65,67,150	5,676
4	Jharkhand	Rural	29,492	2,902	0	47,29,369	324
		Urban	0	0	228	15,25,412	3,273
5	Odisha	Rural	47,675	3,636	0	80,89,987	230
		Urban	0	0	223	15,47,833	2,090
6	Chhattisgarh	Rural	19,567	559	0	43,65,568	149
		Urban	0	0	182	12,85,156	1,826
7	Madhya Pradesh	Rural	51,929	2,974	0	1,10,80,278	175
		Urban	0	0	476	40,12,978	2,591
8	Gujarat	Rural	17,843	382	0	67,73,558	184
		Urban	0	0	348	54,74,870	3,477
9	Maharashtra	Rural	40,959	2,706	0	1,32,14,738	206
		Urban	0	0	534	1,12,06,781	5,588
10	Andhra Pradesh	Rural	26,286	1,514	0	1,42,34,387	211
		Urban	0	0	353	67,88,201	3,593
11	Karnataka	Rural	27,397	1,943	0	79,46,657	202
		Urban	0	0	347	54,10,370	3,928
12	Goa	Rural	320	14	0	1,28,208	188
		Urban	0	0	70	2,15,403	1,186
13	Kerala	Rural	1,017	1	0	41,49,641	559
		Urban	0	0	520	37,04,113	2,097
14	Tamil Nadu	Rural	15,049	930	0	95,28,495	320
		Urban	0	0	1,097	89,96,487	2,561

(Source: Census of India, 2011)

Goa and Kerala present unique cases. Goa has a relatively low urban density of 1,186 persons per square kilometres, whereas Kerala, despite its small size, has a high rural density of 559 persons per square kilometres and an urban density of 2,097 persons per square kilometres. Tamil Nadu shows balanced rural and urban densities (320 and 2,561 persons per square kilometres, respectively), indicating well-distributed populations. These data underscore the diverse demographic patterns and levels of urbanisation across the states of Indian peninsula, highlighting the distinct rural-urban dynamics in each region.

10.4.3 Economy

Economy of Indian peninsula is diverse and dynamic, contributing significantly to the country's overall economic growth. This region has a mix of agriculture, industry, and services sectors. The economy is well explained with the help of land use data shown in Table 10.4. The data analysis shows the distribution of geographical areas into forests, non-agricultural uses, barren lands, permanent pastures, miscellaneous tree crops, culturable wasteland, current fallow land, net sown area, and total cropped area. Andhra Pradesh, with a geographical area of 16,297 thousand hectares, exhibits significant agricultural activity, with 5,884 thousand hectares as net sown area, supported by substantial forest cover and non-agricultural land use. Chhattisgarh, covering 13,519 thousand hectares, stands out with the highest proportion of forest cover at 6,307 thousand hectares, followed by significant agricultural land use. Goa, despite its small geographical area of 370 thousand hectares, balances between forests and agriculture with a modest net sown area. Gujarat, spanning 19,624 thousand hectares, emphasises agriculture with extensive net sown area and total cropped area, despite significant non-agricultural land use.

Table 10.4: Land Use Classification, 2019-20 (in Thousand Hectares)

S. No.	State	Geographical area	Forests	Not available for cultivation		Other uncultivated land excluding fallow land				Net sown area	Total cropped area
				Area under non-agri-cultural uses	Barren & uncultur-able land	Permanent pastures and other grazing lands	Land under misc. Tree crops and groves	Culturable waste land	Current fallow land		
1	Andhra Pradesh	16297	3688	2074	1336	206	155	412	1452	5884	7287
2	Chhattisgarh	13519	6307	750	287	893	3	366	291	4635	5735
3	Goa	370	125	94		1	1	5	5	127	147
4	Gujarat	19624	2119	1420	2077	807	4	1901	663	9787	13816
5	Jharkhand	7972	2239	736	584	131	144	369	1439	1291	1760
6	Karnataka	19179	3073	1511	752	871	238	390	925	10804	13831
7	Kerala	3885	1082	562	11		2	100	57	2026	2586
8	Madhya Pradesh	30825	8704	2174	1354	1336	21	875	374	15512	28277
9	Maharashtra	30771	5222	1712	1882	1353	273	935	1444	16722	23856
10	Manipur	2233	1660	26	1	1	6	1	0	331	331
11	Odisha	15571	5216	1383	948	535	260	577	1055	4102	4670
12	Rajasthan	34224	2770	2007	2372	1667	29	3717	1555	18032	27515
13	Tamil Nadu	13006	2157	2203	457	108	221	322	920	4738	5942
14	Telangana	11208	2698	836	607	281	112	162	444	5500	7479
15	West Bengal	8875	1175	1890	8	2	43	11	300	5250	10100

(Source: Landuse Statistics at a Glance (Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare Ministry of Agriculture and Farmers Welfare, Government of India, 2023).

Jharkhand's 7,972 thousand hectares are balanced between forests and agriculture, with a notable portion of the land being forested. Karnataka, with 19,179 thousand hectares, has a large net sown area at 10,804 thousand hectares, supported by considerable forest areas and other uncultivated lands. Kerala, covering 3,885 thousand hectares, efficiently uses its land for agriculture, with a significant net sown area of 2,026 thousand hectares and substantial forest cover. Madhya Pradesh, with the largest total cropped area of 28,277 thousand hectares, leads in agricultural dominance, supported by substantial forest cover of 8,704 thousand hectares. Maharashtra, covering

30,771 thousand hectares, has a strong agricultural sector with extensive net sown area and total cropped area, balanced with significant forest cover.

Manipur is primarily forested, with 1,660 thousand hectares out of 2,233 thousand hectares, and shows limited agricultural activity. Odisha balances its 15,571 thousand hectares between forests and agriculture, with 5,216 thousand hectares under forest cover. Rajasthan, the largest in geographical area at 34,224 thousand hectares, has a substantial net sown area of 18,032 thousand hectares, indicating extensive agricultural activities despite its arid conditions. Tamil Nadu efficiently uses its 13,006 thousand hectares for agriculture, with notable forest cover and 4,738 thousand hectares net sown area. Telangana, with 11,208 thousand hectares, shows balanced land use with substantial agricultural activity and significant forest cover. West Bengal, covering 8,875 thousand hectares, emphasises agriculture with 5,250 thousand hectares net sown area and 10,100 thousand hectares as the total cropped area, complemented by forest cover.

The region's diverse climatic conditions and fertile soil make it conducive for a wide variety of crops like rice, wheat, sugarcane, cotton, pulses, oilseeds, and spices. Coastal areas are known for cash crops like coconut, cashew, and spices. Adoption of modern agricultural practices, irrigation systems, and crop diversification has led to increased agricultural productivity and playing a significant role in sustaining livelihood of millions of farmers in the region.

Industrial Economy:

Indian peninsula is home to several prominent industrial and manufacturing hubs those significantly contribute to the country's industrial output. Tamil Nadu, with its capital Chennai, is renowned for its automobile manufacturing industry, hosting major companies like Hyundai, Ford and Renault-Nissan. Bengaluru, Karnataka, stands out as the "Silicon Valley of India," a global IT and technology hub with numerous software companies, startups, and research institutions. Additionally, the region boasts well-established chemical industry, textile industry, and manufacturing units of consumer goods.

Services sector in Indian peninsula has experienced exceptional growth, largely driven by information technology (IT) and software services industry. Bengaluru and Hyderabad, two prominent cities in the region, serve as IT hubs, contributing significantly to India's IT exports. These cities house a multitude of IT companies, tech startups and research centres. Furthermore, tourism and hospitality sector is vital in states like Kerala, Tamil Nadu and Goa attracting tourists from across the world, bolstering both local economy and employment opportunities.

With an extensive coastline along the vast expanse of Arabian Sea and Bay of Bengal, maritime trade and ports play pivotal role in India's economy. Major ports such as Chennai, Mumbai, Kochi, and Vishakhapatnam facilitate international trade, handling substantial volumes of cargo for both exports and imports. Establishment of special economic zones (SEZs) and dedicated industrial corridors has further enhanced potential for trade activities, contributing to the region's prosperity and economic growth.

10.4.4 Transport and Communication

The diverse physiography of peninsular India has significantly influenced the evolution of its transport and communication networks. Ancient trade routes crisscrossing the expansive Deccan plateau laid the foundation for the intricate road systems seen today, including historical routes like the Grand Trunk Road and the contemporary Golden Quadrilateral (launched in 2001), which spans 5,800 kilometres, connecting major metropolitan cities such as Chennai, Mumbai, Delhi, and Kolkata. The peninsula's complex topography, including hills, plateaus, and coastal regions, has shaped the development of highways like NH-44, NH66, NH-48, NH-206, NH-544, and NH-65, facilitating trade and travel across diverse physical landscapes.

Railways, introduced during the mid-19th century colonial period, demonstrate remarkable engineering adaptability to the region's challenging terrain. The Konkan Railway, stretching 760 kilometres through the Western Ghats, reflects the transformative impact of railways on connectivity and economic growth. The Southern Railway Zone and Konkan Railway enhance connectivity along the western coast, threading through intervening maze of hills and valleys.

The peninsula's air transport network, vital for overcoming geographical barriers, has strategically positioned airports to serve as gateways. Chennai International Airport, with a history dating back to the pre-independence era, stands as a primary international gateway for the southern peninsula. Goa's Dabolim Airport, positioned along the west coast, has played a pivotal role in connecting the coastal state with rest of the country and the world. The geographical features, including the extensive coastline, have contributed to the importance of coastal towns and cities like Mumbai, Chennai, and Kochi, serving as vital ports and trading hubs.

The waterways, historically significant for trade, underwent modernisation to harness major rivers like the Godavari, Krishna, and Cauvery for inland transport. The fertile deltas in coastal areas became natural corridors for maritime trade, with ports like Chennai and Kochi underscoring the historical importance of waterways in connecting the peninsular region.

SAQ 4

Which are the major ports in the Arabian Sea and Bay of Bengal facilitating international trade and handling substantial volumes of cargo for both exports and imports?

10.5 INDIAN PENINSULA: THE REGIONS

Peninsular India, also commonly referred to as Deccan plateau and coastal plains, constitutes a vast complex landmass situated in southern part of Indian subcontinent. The complexities of the landmass are so enormous that geographers could not be able to decide to include/exclude coastal plains and the deserts in the Deccan plateau or not. But however, we have a few

important geographers who have demarcated the Indian peninsula which are widely accepted. Dudley Stamp, has categorised it into 10 sub-divisions:

i. **Coastal Region around the Plateau Proper:** Encompassing areas like Kutch, Kathiawar, and Gujarat coasts, it forms a transition zone between the dry Indus valley and the Thar desert and the very humid west coast.

ii. **West Coast Region:** This area lies between the crest of the Western Ghats and the Arabian sea, consisting of a narrow coastal plain and the slopes of the Western Ghats.

iii. **Karnatak or Tamil Region (East Coast South):** Covering a broad coastal plain and an inland hilly tract, this region is alternatively referred to as the East Coast South.

iv. **Northern Circars Region (East Coast North):** Including Orissa, it lies between the Eastern Ghats and the Bay of Bengal.

v. **Deccan Plateau (Strict Sense):** Covering the high southern portion of the plateau.

vi. **Deccan Lava Region:** Situated in the northwestern part of the plateau and corresponding with the Black Cotton Area.

vii. **North-East Part of the Plateau:** This complex region comprises five further subdivisions, namely the Central Indian Highlands, Chotanagpur plateau, Eastern Ghats, Chhatisgarh plain or Mahanadi valley, and the Godavari valley.

viii. **Central Indian Region:** Positioned between the Ganges plain and the Narmada-Son trough.

ix. **Rajput Upland Region:** A complex region of hills and plateaus situated between the Vindhyas in the south and the Aravalli hills in the North-West.

x. **Thar or the Great Indian Desert:** Encompassing the arid expanse known as the Thar desert.

Similarly, R.L. Singh has also divided peninsular land into twelve Meso-level regions which are as follows:

Udaipur-Gwalior Region, Malwa Region, Bundelkhand Region, Vindhyanchal-Baghelkhand Region, Chotanagpur Region, Meghalaya-Mikir Region, Maharashtra Region, Chhattisgarh Region, Odisha Highland Region, Dandakaranya, Karnataka Plateau, Andhra Plateau, Tamil Nadu Uplands and South Sahyadri.

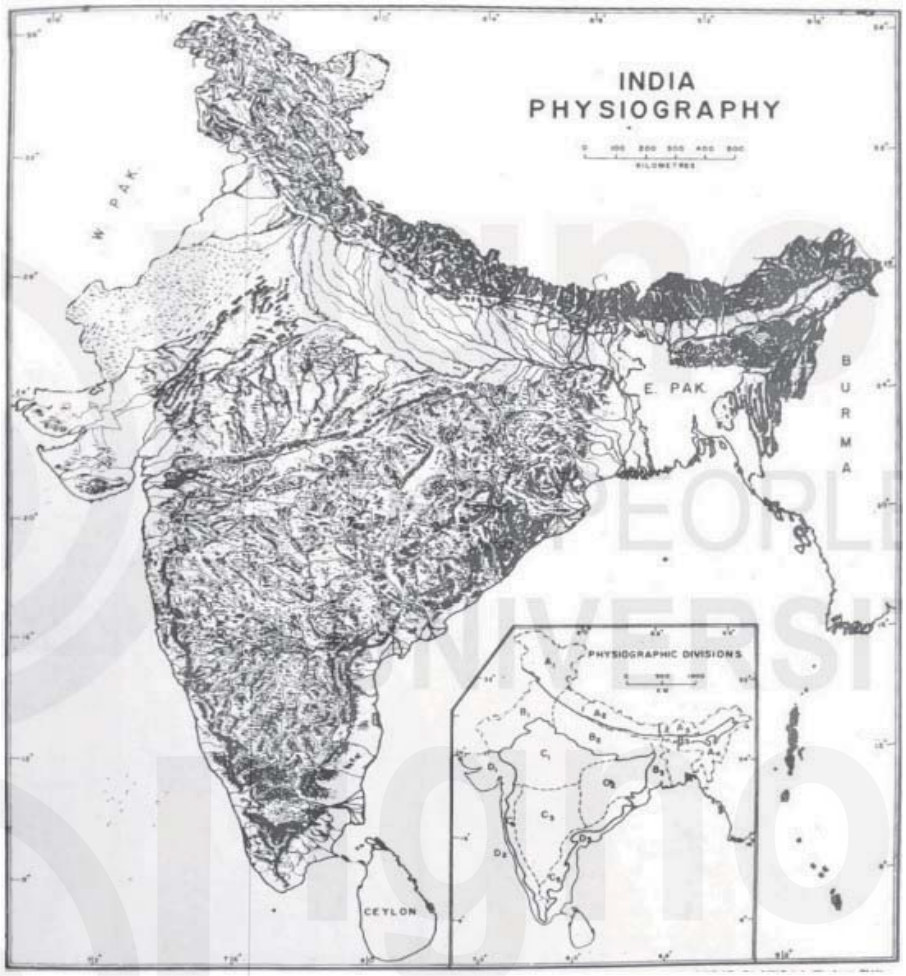


Fig. 10.2: Physiographic Divisions of India.

A. Northern Mountains: 1. Western; 2. Central; 3. Eastern; 4. Assam-Meghalaya Hills.
B. Great Plains: 1. Western Plain; 2. Central Plains; 3. Eastern Plain.
C. Peninsular Upland: 1. Aravalli-Satpura Uplands; 2. North Eastern Upland Complex; 3. Deccan Uplands; 4. Western Ghats; 5. Eastern Ghats.
D. Coastal Plains: 1. Gujarat Coastal Plain; 2. West Coast Plain; 3. East Coast Plain

(Source: India: A Regional Geography by Singh, R. L. Reprint, 2010)

10.6 INDIAN PENINSULA: PROBLEMS AND PROSPECTS

The peninsula part of India, sandwiched between the Arabian sea and the Bay of Bengal, grapples with a dynamic geographical landscape that intricately weaves challenges and opportunities. Characterised by climatic variations influenced by the Western Ghats and the Deccan plateau, the region experiences diverse weather patterns, from arid conditions in certain areas to tropical climates in others.

A prominent challenge faced by the peninsula is the issue of water scarcity, particularly evident in the Deccan plateau. Erratic rainfall and inadequate water resource management have led to water stress, affecting agricultural resilience. Implementing sustainable water management practices and watershed development initiatives are crucial to mitigate such challenges.

The peninsula is susceptible to the forces of nature, experiencing cyclones, floods, and droughts. Coastal areas are vulnerable to cyclonic disturbances from the Bay of Bengal, necessitating robust disaster preparedness. Inland

regions grapple with the consequences of erratic monsoons, emphasising the need for climate-resilient agricultural practices and infrastructure.

Despite these challenges, the peninsula holds immense prospects driven by its unique geography. The Western Ghats, a UNESCO World Heritage site and biodiversity hotspot, present opportunities for eco-tourism, biodiversity research, and sustainable resource utilisation. Conservation efforts in these lush hills can unlock economic potential.

The strategic location of the peninsula, flanked by major water bodies, offers opportunities for maritime trade and connectivity. Coastal states can harness economic potential through their ports, facilitating trade routes and fostering economic growth. The extensive coastline also presents untapped potential for renewable energy, with wind and solar resources waiting to be harnessed for sustainable power generation.

Agricultural potential remains a key prospect, notwithstanding water-related challenges. Implementing sustainable farming practices, watershed management, and irrigation projects can enhance agricultural productivity, contributing to food security and rural development.

The peninsula's rich cultural heritage and historical landmarks provide a unique opportunity for tourism. Proper preservation and promotion of these assets can turn tourism into a significant economic driver. Historical cities like Bengaluru, Chennai, and Hyderabad, emerging as hubs of economic growth and innovation, underscore the prospects of urbanisation. Improving transportation infrastructure, such as road and rail networks, plays a pivotal role in enhancing connectivity, promoting economic integration, and overcoming geographical barriers. Efficient transportation fosters regional development and social cohesion.

SAQ 5

In how many sub-divisions Dudley Stamp has divided peninsular India?

10.7 ISLANDS: HISTORICAL BACKGROUND

Historical background of islands of India surrounding the subcontinent is a tale of ancient civilisations, maritime trade, colonial encounters and cultural diversity. The islands of India, including Andaman and Nicobar islands and Lakshadweep islands, hold their own intriguing histories. Andaman and Nicobar islands witnessed colonial occupation and establishment of notorious Cellular Jail during the British rule. These islands also stood testimony to the challenges of Japanese occupation during World War II. Lakshadweep islands have a unique cultural heritage intertwined with their maritime environment.

Like Indian peninsula, islands of India also showcase vibrant interplay of cultures, trade, and colonialism in tandem. Islands have contributed to India's historical narrative which has also helped to shape its socio-cultural diversity; rich biodiversity coupled with strategic significance.

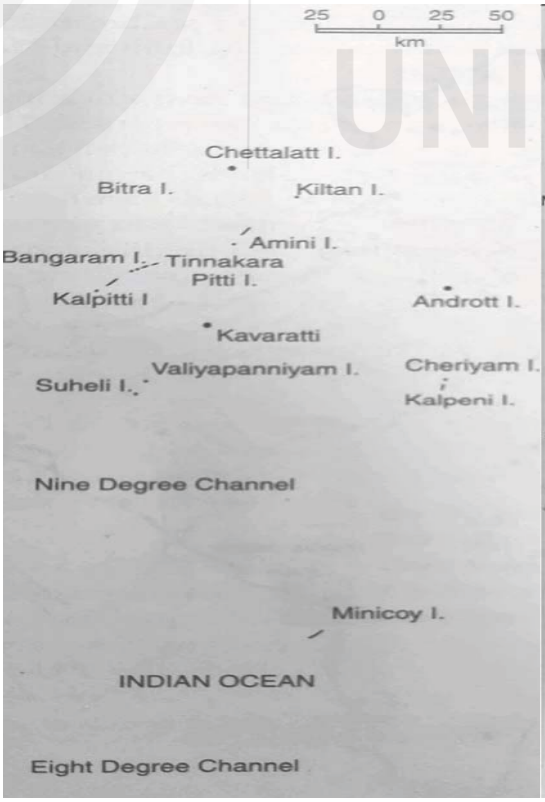
10.8 ISLANDS: THE PHYSICAL SETTINGS

10.8.1 Geology

Geology of the islands of India is diverse and influenced by unique geological processes those have shaped these isolated land masses. Andaman and Nicobar islands, located in the Bay of Bengal, have volcanic origin. These islands are part of volcanic island arc system associated with the sub-duction of Indian Plate beneath the Burma Plate. Presence of volcanic rocks, such as basalt, and volcanic features like volcanic cones, highlight their volcanic history. Many islands in Andaman and Nicobar archipelago are characterised by extensive limestone formations. These limestone formations have been shaped by geological processes like sedimentation, erosion, and tectonic activity, resulting in unique landscapes such as limestone caves and karst topography. The islands are renowned for their coral reefs, particularly in the Lakshadweep Islands. Coral reefs are formed by accumulation and growth of coral polyps, over millions of years. These reefs support rich marine biodiversity and are critical for ecological health of the surrounding seas. The islands are situated in a seismically active region, and historical records show instances of earthquakes. Tectonic processes those led to the formation of the islands continue to influence geology and topography of the region.

10.8.2 Physiography/Relief

Islands of Andaman and Nicobar and Lakshadweep, located in the Bay of Bengal and Arabian sea, respectively, exhibits distinct physiographic features and relief characteristics due to their unique geological origins and geographical settings.



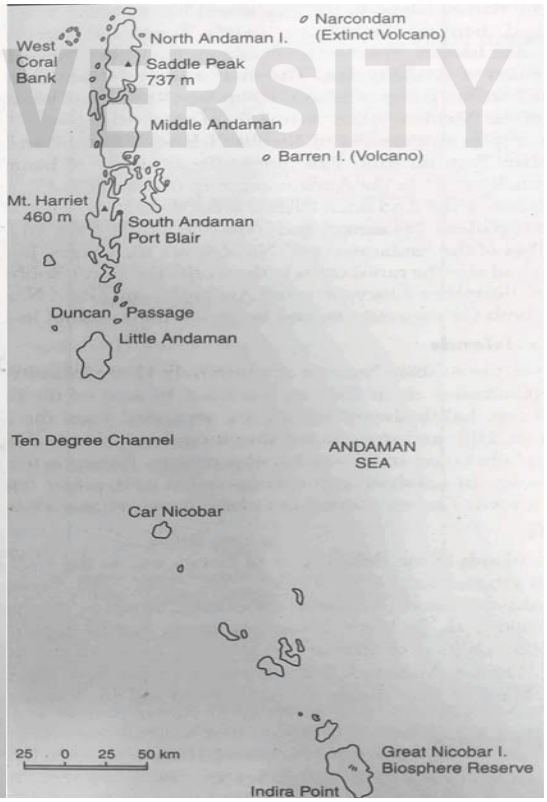


Fig. 10.3: Andaman and Nicobar. **Fig.10.4: Lakshadweep.**
(Source: Geography of India, Majid Hussian, 2013)

Andaman and Nicobar islands are characterised by rugged and hilly terrain. These boast some of highest peaks named Saddle peak on North Andaman in Bay of Bengal region, with height reaching over 2,400 metres above mean sea level. These hill ranges have steep escarpments, deep valleys, and dense forests, creating a visually stunning landscape and resources for supporting livelihood of local populace.

Lakshadweep islands are of coral atolls in origin. These are the result of accumulation and growth of coral reefs.

Unlike volcanic origins of Andaman and Nicobar islands, Lakshadweep islands are in the form of atolls formed through deposition of coral skeletons over time. Lakshadweep islands are low-lying and consist of a group of 36 coral atolls and islets. These atolls are surrounded by fringing coral reefs and have shallow lagoons in their interiors. The islands have a characteristic flat and gently sloping topography.

10.8.3 Drainage and Water Resources

Islands of India, including Andaman and Nicobar islands, Lakshadweep islands, Sriharikota island, and Diu island, each possesses distinctive characteristics in terms of their drainage patterns and water resources.

Andaman and Nicobar islands, a picturesque archipelago in south-eastern portion of Bay of Bengal, are relatively devoid of significant rivers. Instead, these are embraced by saline water of Bay of Bengal. Freshwater on these islands primarily depends on rainfall, collected through rainwater harvesting systems, and stored in reservoirs and tanks. Groundwater, though available, requires careful management to prevent saltwater intrusion into freshwater aquifers. Sustainable water practices are essential for sustaining the islands' ecosystems and meeting the daily needs of local population, besides commercial purposes.

Similarly, Lakshadweep islands, composed of atolls and coral reef in Arabian sea, lack significant river system. Their flat terrain accentuates their reliance on rainwater harvesting. Rain is collected from rooftops and stored in underground tanks thus providing a critical source of drinking water. Due to limited groundwater resources resulting from coral formation, effective freshwater management and conservation are imperative to address the growing demands of tourism and of islands' residents as well.

Sriharikota island, located in Bay of Bengal off the coast of Andhra Pradesh, is primarily known as site of Satish Dhawan Space Centre. This island's small size and absence of significant rivers result in reliance on desalination plants and freshwater supply from mainland to meet its water requirements. Given its vital role in India's space program, the island's infrastructure is designed to cater to scientific and technical community residing over there.

Diu island, situated off the coast of Gujarat in the Arabian sea, similarly grapples with limited freshwater resources. While it has access to some groundwater, the island primarily relies on desalination plants, small dams, and reservoirs to meet its demands. Due to its semi-arid climate, efficient water management and conservation practices are necessary for sustainable provision of freshwater to its inhabitants.

10.8.4 Climate

Islands of India, scattered across Arabian Sea and Bay of Bengal, boast diverse and distinct climate, each shaped by their geographical location and proximity to the sea.

Andaman and Nicobar islands, situated in the Bay of Bengal, experiences tropical maritime climate. These islands enjoy warm temperatures throughout the year, with maximum temperatures ranging from 24°C to 30°C. The islands receive ample rainfall during southwest monsoon season from June to September, and during northeast monsoon season from November to December. Its annual average rainfall is upto 3,000 millimetres (118 inches). High humidity levels are typical due to their proximity to sea, contributing to lush greenery that characterises the islands. These islands are also prone to cyclones during monsoon seasons, which can bring heavy rain and strong winds and may also inflict damage to the ecosystem and infrastructural amenities.

Lakshadweep islands, located in Arabian sea, share tropical maritime climate similar to Andaman and Nicobar islands. They enjoy warm and relatively stable temperatures year-round, with maximum temperatures ranging from 31°C to 34°C. Rainfall is comparatively lower than Andaman and Nicobar islands, with southwest monsoon season (June to September) being wettest period. Like their counterparts, high humidity levels are prevalent, influenced by surrounding sea. Cyclones can affect the region during monsoon season, leading to increased rainfall and rough seas.

Sriharikota island, off the coast of Andhra Pradesh, experiences tropical wet and dry climate influenced by its proximity to mainland. Summers on the island are hot and humid, with maximum temperature often exceeding 35°C. Winters are relatively cooler, with maximum temperatures hovering around 25°C to 30°C. The island receives most of its rainfall during southwest monsoon season (June to September), with relatively drier season from October to December. It is also susceptible to cyclones during monsoon season, adding to climate's variability and challenges for local inhabitants.

Diu island situated off the coast of Gujarat, experiences tropical wet and dry climate with some sub-tropical characteristics. Summers on the island are hot, with maximum temperatures reaching 35°C to 40°C (95°F to 104°F). Winters are cooler, with maximum temperatures ranging from 20°C to 30°C (68°F to 86°F). Diu receives most of its rainfall during southwest monsoon season (June to September), with relatively dry period from October to May. Moderate to high humidity levels are common, impacting the island's overall climate. Diu is also susceptible to cyclones during monsoon season, affecting the island's weather patterns and precipitation.

10.8.5 Vegetation

The islands of India boast assemblage of diverse and unique vegetation, each intricately shaped by its geographical context. The Andaman and Nicobar islands, positioned in the Bay of Bengal, features tropical rainforests with evergreen and semi-evergreen trees, including Teak and Mahogany

(commercially valuable). Coastal mangrove ecosystems, with species like Sundari trees, contribute to shoreline protection from the ingression of tidal waters. In Lakshadweep islands lying in the Arabian sea, an extensive coconut grove dominates the landscape, adapted to the coral atoll conditions. Sparse natural vegetation, comprising hardy shrubs and grasses, prevails due to the challenging nature of physical environment. Sriharikota island off the coast of Andhra Pradesh, a pivotal space launch site, has undergone artificial landscaping. Conservation efforts strive to minimise ecological disruptions resulting from space activities. Diu island, off Gujarat's coast, exhibits a vegetation profile tailored to its semi-arid climate. Casuarina trees stabilise sand dunes along the coastline, while hardy shrubs thrive in the arid interior parts. These distinct vegetation profiles underscore the islands' efforts to balance ecological conservation with their unique geographical characteristics.

10.8.6 Soils

The islands of India, specifically the Andaman and Nicobar islands and Lakshadweep, exhibit distinctive soil compositions influenced by their geographical locations. In the Andaman and Nicobar islands, tropical conditions, characterised by high temperatures and substantial rainfall, foster the development of red and laterite soils. Coastal areas feature alluvial soils, shaped by the deposition of sediments from rivers and marine processes. Unique to this region is Barren island, where volcanic activities in the past have contributed to the presence of volcanic soils.

Shifting focus to Lakshadweep, the soil composition is predominantly coral sand, reflective of its coral atoll nature. The remnants of coral debris contribute to the formation of sandy soils, underscoring the islands' unique geology. The influence of marine deposits, coupled with proximity to the surrounding sea, results in the prevalence of alluvial soils. In certain low-lying areas, the intrusion of saltwater gives rise to saline soils. This intricate interplay of geological and environmental factors shapes the soil profiles of these islands, influencing their ecosystems and agricultural practices.

10.8.7 Physical Resource Base

Islands of India, encompassing the Andaman and Nicobar islands and Lakshadweep, exhibit a physical resource base intricately tied to their geographical settings. In the Andaman and Nicobar islands, the geographical richness is reflected in the presence of valuable mineral deposits, including limestone and dolomite. The unique topography and climate of these islands support lush forests, fostering diverse flora and fauna, some of which are endemic to the region. The timber industry benefits from the abundance of hardwood resources, further boosting the islands' economic landscape. Geographically, the Andaman and Nicobar islands form an archipelago in the south-eastern Bay of Bengal, highlighting their strategic location and resource potential.

On the other hand, Lakshadweep, situated southwest of the Indian mainland, supports an extensive coral reef system, forming a vital ecological and economic resource. The coral formations not only contribute to the marine biodiversity of the region but also sustain a thriving fishing industry. The

geographical relevance of Lakshadweep's marine resources extends to its tourism potential, with pristine beaches and rich marine life attracting visitors. The coral atoll nature of Lakshadweep shapes its distinct geographical identity and underscores the importance of its physical resources in supporting both the environment and the local economy.

SAQ 6

Which tectonic plates are associated with the formation of Andaman and Nicobar islands?

10.9 ISLANDS: THE CULTURAL SETTING

Cultural setting of islands is a tapestry interwoven with diverse traditions, languages, religions and lifestyles those have evolved over millennia. This micro region, encompassing group of islands and the scattered archipelagos, represents rich mosaic of indigenous and colonial cultures. It stands testimony to the influence of historical, geographical, and socio-economic factors since time immemorial. Its cultural setting has evolved from ancient civilisations to modern urban centres representing Hinduism, Christianity and other faiths and beliefs. Its cultural landscape showcases dynamism of indigenous and modern cultures simultaneously.

10.9.1 Population

Population of the islands of India has distinctive characteristics due to their geographical isolation, unique cultural diversity, and environmental challenges. Andaman and Nicobar islands are home to several indigenous communities, such as the Great Andamanese, Jarawa, Onge, and Sentinelese. These communities have inhabited the islands for centuries, practicing traditional ways of life and preserving their distinct language and culture. Lakshadweep islands have a predominantly Malayali Muslim population, reflecting historical ties with the nearby Kerala state.

Table 10.5: Population Characteristics of Indian Peninsular States

S. NO.	Name	Total Population	Population Density	Sex Ratio	Literacy Rate (%)		
					Total	Male	Female
1.	Andaman and Nicobar	379,944	46	878	86.63	90.27	82.43
2.	Lakshdweep	64,473	2,013	946	91.85	95.56	88.25
3.	Daman and Diu	242,911	2,169	618	87.07	91.48	81.02

(Source: Census of India, 2011)

Table 10.5 shows that the Andaman and Nicobar islands, Lakshadweep, and Daman and Diu reveal distinct demographic and socio-economic characteristics influenced by their geographical contexts. The Andaman and Nicobar islands have a total population of 3,79,944, which is relatively small compared to other Indian states and union territories. The population density is notably low at 46 persons per square kilometre, reflecting vast stretches of sparsely populated areas due to the archipelago's rugged terrain, dense forests, and numerous protected areas. Sex ratio in the Andaman and

Nicobar islands is low at 878 females per 1000 males. It is below the national average, indicating towards gender imbalance influenced by various socio-economic factors. The literacy rate is impressively high at 86.63 percent, with male literacy at 90.27 percent and female literacy at 82.43 percent. This high literacy rate demonstrates the region's commitment to education despite its remote location, although the disparity between male and female literacy rates indicates some gender inequality in educational attainment.

Lakshadweep, with a much smaller population of 64,473, is India's smallest Union Territory by population. However, it has a significantly high population density of 2,013 persons per square kilometre, making it one of the most densely populated regions in India. This high density can be attributed to its limited land area combined with the concentration of population on a few inhabited islands. The sex ratio in Lakshadweep is relatively balanced at 946 females per 1000 males, closer to the national average and indicating a healthier gender balance compared to the Andaman and Nicobar islands. Lakshadweep also boasts a very high literacy rate of 91.85 percent, with male literacy at 95.56 percent and female literacy at 88.25 percent. This indicates strong educational infrastructure and outreach, although the gap between male and female literacy rates highlights areas needing further improvement in gender equality in education.

Daman and Diu, with a total population of 242,911, has a very high population density of 2,169 persons per square kilometre, which is higher than even Lakshadweep. This high density results from its small geographical area combined with a substantial population. The sex ratio in Daman and Diu is strikingly low at 618 females per 1000 males, one of the lowest in the country, indicating a significant gender imbalance that could result from socio-economic and cultural factors. The literacy rate in Daman and Diu is 87.07 percent, with male literacy at 91.48 percent and female literacy at 81.02 percent. While the overall literacy rate is high, the substantial gap between male and female literacy rates points to considerable gender inequality in educational attainment.

10.9.2 Settlement

The Andaman and Nicobar Islands stretch from the Arakan Yoma range in the north to Sumatra in the south and consist of about 572 islands. It is located 100 kilometres north of Aceh, Indonesia, and is separated from Thailand and Myanmar (Burma) by the Andaman Sea to the east, while the Bay of Bengal lies to the west. The islands are divided into two groups - the Andaman Islands and the Nicobar Islands, which are separated by the 10-degree north parallel. The total length of the islands from north to south is 476 kilometres, covering an area of 8,249 square kilometres in the Bay of Bengal. The shortest distance from the Indian mainland is 1,362 kilometres.

The settlement pattern of Andaman and Nicobar Islands is mainly coastal and dispersed, with Port Blair as the urban centre. Urbanisation is prominent along the coast, with Port Blair serving as the capital and major city, witnessing recent development. The Cellular Jail in Port Blair reflects the islands' colonial penal history. Post-independence, migration from mainland India has diversified demographics, impacting urban areas. The unique

lifestyle of indigenous tribes and geographical isolation continue to influence settlement patterns. Most settlements are linear along the coast, while tribal groups like the Jarwa, Onge, and Nicobarese live in isolated forest areas. Post-independence, planned settlements developed with structured housing and road networks. The morphology of settlements varies; linear settlements dominate coastlines, clustered villages exist in Nicobar, and scattered homes are found in forested regions. Indigenous communities build stilt houses, while urban areas have modern concrete buildings. The geography and lifestyle shape the diverse settlement patterns across the islands.

The Lakshadweep Islands are the northernmost islands in the Lakshadweep-Maldives-Chagos group. These islands are actually the peaks of a vast underwater mountain range, known as the Chagos-Laccadive Ridge, in the Indian Ocean. Lakshadweep is an archipelago consisting of 12 atolls, three reefs, and five submerged banks, with a total of 36 islands and islets and covering a total land area of Lakshadweep is 32 square kilometres. They are located 200 to 440 kilometres off the southwest coast of India and are divided into three groups: the Northern Group (Amindivi Islands), the Southern Group (Laccadive or Cannanore Islands), and the Minicoy Islands, which are at the southern end of the Nine Degree Channel. The North and South groups are separated by the 11-degree north parallel but are connected by an underwater ridge.

In Lakshadweep, primary settlements are coastal and island communities closely linked to the marine environment. Proximity to the sea is a defining feature, with traditional construction techniques addressing coastal challenges. Homes are designed to withstand saltwater, strong winds, and occasional cyclones, reflecting the geographical context.

Table 10.6: Rural and Urban Settlements in the Island of Peninsular India

S. No.	Name	Total/ Rural/ Urban	Number of villages		Number of towns	Number of households	Population			Area (In sq. km)	Population per sq. km.
			Inhabited	Uninhabited			Persons	Males	Females		
1	Daman and Diu	Rural	19	0	0	12,744	60,396	32,395	28,001	62.48	967
		Urban	0	0	8	48,212	1,82,851	1,17,906	64,945	48.52	3,769
2	Lakshadweep	Rural	6	15	0	2,710	14,141	7,243	6,898	9.17	1,542
		Urban	0	0	6	8,864	50,332	25,880	24,452	20.83	2,416
3	Andaman and Nicobar Islands	Rural	396	159	0	58,530	2,37,093	1,26,287	1,10,806	8211.08	29
		Urban	0	0	5	36,021	1,43,488	76,584	66,904	37.92	3,784

(Source: Census of India, 2011)

Table 10.6 shows the distinct geographical and demographic patterns of the Andaman and Nicobar islands, Lakshadweep and Daman and Diu. Daman and Diu is predominantly urban, with eight towns hosting 1,82,851 people with high density of 3,769 persons per square kilometres, contrasting with its rural area of 60,396 people with 967 persons per square kilometres. Lakshadweep shows a balanced rural-urban distribution but faces significant population pressure due to its small land area, with urban densities reaching 2,416 persons per square kilometres compared to 1,542 in rural areas. The Andaman and Nicobar islands, while primarily rural with 2,37,093 people spread thinly at 29 persons per square kilometres, have densely populated

urban areas with 1,43,488 people at 3,784 persons per square kilometres. These patterns reflect varying degrees of urbanisation and land use across these territories.

10.9.3 Economy

The islands of India, Andaman and Nicobar islands, Dadar and Nagar Haveli and Daman Diu and Lakshadweep islands, exhibit a unique economic landscape influenced by their remote locations and geographical features. Fishing, a primary economic activity, capitalises on the islands' proximity to the sea and rich marine biodiversity, particularly in Andaman and Nicobar islands, known for tuna and prawn fishing. The tourism sector leverages the natural beauty of the islands, including pristine beaches and coral reefs, attracting visitors seeking underwater adventure based experiences.

Table 10.7: Land Use Classification, 2019-20 (in Thousand Hectares)

S. No.	Islands	Geographical Area	Forests	Not available for cultivation		Other uncultivated land excluding fallow land				Net sown area	Total cropped area
				Area under non-agricultural uses	Barren and unculturable land	Permanent pastures and other grazing lands	Land under misc. tree crops and groves	Culturable waste land	Current fallow land		
1	Andaman and Nicobar	825	674	7	2	4	4	3	3	15	46
2	Dadar and Nagar Haveli and Daman and Diu	60	20	4	0	0	0	0	0	23	23
3	*Lakshadweep*	3	3	1	-	-	-	-		2	2

(Source: Landuse Statistics at a Glance (Directorate of Economics & Statistics Department of Agriculture and Farmers Welfare Ministry of Agriculture and Farmers Welfare, Government of India, 2023))

Geographical constraints limit agriculture to coconut, betel nut, and small-scale cultivation, emphasising subsistence farming for food security. Additionally, government employment, particularly in defense due to strategic importance, plays a pivotal role in the islands' economies, showcasing the intersection of geography and economic activities. Table 10.7 highlights the land use patterns of the island territories of Andaman and Nicobar, Dadar and Nagar Haveli and Daman and Diu, and Lakshadweep. The Andaman and Nicobar Islands, with a geographical area of 825 thousand hectares, are predominantly covered by forests (674 thousand hectares), with minimal land dedicated to agriculture (15 thousand hectares net sown area). Dadar and Nagar Haveli and Daman and Diu, spanning 60 thousand hectares, have 20 thousand hectares of forest and a small agricultural area of 23 thousand hectares. Lakshadweep, the smallest territory at 3 thousand hectares, is entirely forested with minimal agricultural activity (2 thousand hectares net sown area). These territories show a significant emphasis on forest cover, particularly in Andaman and Nicobar and Lakshadweep, with limited land available for cultivation, highlighting their ecological importance and the balance between conservation and agriculture.

10.9.4 Transport and Communication

The transport and communication infrastructure of the Indian islands, comprising the Andaman and Nicobar islands and Lakshadweep, is vital for addressing the unique challenges posed by their remote locations.

Situated in the Bay of Bengal, the Andaman and Nicobar islands rely on the Veer Savarkar International Airport in Port Blair for air connectivity. A network of seaports facilitates maritime transport. The islands' strategic location on international maritime trade routes underscores the importance of robust transport infrastructure, including defense-related connectivity. However, in the Arabian sea, Lakshadweep depends on boats and helicopters for transport due to its smaller land area. The Agatti Airport connects the islands by air. Geographically important along major maritime routes, efficient transport infrastructure are vital for economic activities and tourism.

Indian Government has implemented various initiatives to promote communication connectivity and development in the islands. For example, **the Lakshadweep Optical Fiber Cable Connectivity (LOFCC) project** aims to enhance high-speed internet connectivity in Lakshadweep, further bridging the digital divide and promoting economic development in the region in inclusive manner.

10.10 ISLAND: THE REGIONS

Geographers like R.L. Singh argued that “Indian coasts vary widely in terms of structural and surface characteristics (Singh, 1980 p.8). Therefore, for proper understanding, Indian coasts and Indian islands need to be treated as separate physiographic regions and not to be included in the peninsular part as such.

The islands of India, namely the Andaman and Nicobar islands and Lakshadweep islands, represent distinct regions shaped by their profound physical geography. The Andaman and Nicobar archipelago, situated in the Bay of Bengal, reveals its volcanic origins attributed to the sub-duction of the Indian Plate beneath the Burma plate. This geological history manifests in the prevalence of volcanic rocks such as basalt and geological features like volcanic cones, showcasing a dynamic past. Additionally, extensive limestone formations, shaped by sedimentation, erosion, and tectonic activity, contribute to the creation of unique landscapes, including limestone caves and karst topography. The islands are renowned for their coral reefs, formed over millions of years through the accumulation and growth of coral polyps, providing a testament to the intricate relationship between geological processes and marine biodiversity. Positioned in a seismically active zone, historical records document instances of earthquakes, underscoring the enduring impact of ongoing tectonic processes on the islands' geological framework.

In contrast, Lakshadweep islands in the Arabian sea showcases settlement patterns intimately tied to their coastal and island communities, emphasising adaptation to the surrounding marine environment. This intricate interplay

between geological features and the islands' physical characteristics shapes their distinct identities, within the vast Indian landscape.

10.11 ISLANDS: PROBLEMS AND PROSPECTS

The islands of India, comprising the Andaman and Nicobar islands and Lakshadweep, present a distinct set of challenges and opportunities deeply entwined with their geographical characteristics. Positioned in coastal areas, these islands face heightened environmental vulnerability, making them susceptible to natural disasters like cyclones and tsunamis. Climate change may further exacerbate these risks, thus, raising concerns about sea-level rise and its impact on the fragile ecosystems of these regions. Freshwater scarcity is a common concern, with the Andaman and Nicobar islands relying on rainwater harvesting and freshwater lenses, while Lakshadweep encounters challenges due to its limited freshwater sources, necessitating effective water management practices.

The geographical remoteness of the islands poses unique challenges in terms of connectivity, accessibility, and service delivery, hindering economic development and fostering a dependency on external resources. Conservation efforts are imperative to safeguard the islands' unique flora and fauna, addressing habitat loss and the introduction of invasive species. Despite these challenges, the islands offer significant prospects. Pristine beaches, coral reefs, and diverse marine life make them ripe or ideal sites for sustainable tourism practices that contribute to economic growth while ensuring environmental preservation.

The Andaman and Nicobar islands, strategically located near international sea routes, hold immense potential for maritime security, serving as a crucial naval base and surveillance outpost. The islands also possess a rich cultural heritage, home to indigenous communities whose preservation and promotion present economic opportunities through cultural tourism and traditional handicrafts. Additionally, the islands can harness their geographical location for renewable energy initiatives, utilising solar and wind power to address environmental concerns and enhance energy security.

In navigating these challenges and capitalising on opportunities, strategic planning and sustainable practices are essential. The islands' unique geographical entities demand careful consideration to balance environmental conservation, economic development, and the well-being of their inhabitants.

SAQ 7

Which projects aims to enhance high speed internet connectivity in Lakshadweep?

10.12 SUMMARY

In this Unit, you have learnt the following:

- Prof. S. P. Chatterjee, a renowned geographer, conducted a comprehensive study in 1964, dividing peninsular uplands into eight meso-

physiographic regions i.e. the north central highlands, the south central highlands, the Chhota Nagpur plateau, the Meghalaya-Mikir uplands, the North deccan, the Western Ghats and the Eastern Ghats.

- Rivers originating in the Western Ghats, such as the Tungabhadra, Krishna, and Godavari, flow westward towards the Arabian sea. The Eastern Ghats, on the other hand, contribute to the drainage system of the Bay of Bengal, with rivers like the Mahanadi, Godavari, and Krishna flowing eastward.
- The climate in peninsular India is also influenced by cyclones, with coastal regions along the Bay of Bengal, such as Andhra Pradesh and Odisha, being particularly vulnerable.
- The peninsular part of India is a botanical wonderland, showcasing an extensive array of vegetation shaped by diverse topography, climatic variations, and ecological nuances.
- The peninsular region of India features diverse soils, with black soil, or "regur," being prominent in the Deccan plateau. Derived from basaltic rock weathering, it's rich in minerals like iron and magnesium. Known for its black colour and unique properties, including swelling when wet and forming cracks when dry, black soil is ideal for cultivation of cotton. Its fertility, especially in Maharashtra, Madhya Pradesh, Gujarat, and Karnataka, significantly contributes to India's agricultural output, particularly for cash crops like cotton.
- The Deccan plateau in Karnataka is rich in iron ore, Andhra Pradesh contributes to limestone deposits, and the Western Ghats influence coal and manganese reserves in Maharashtra. This region significantly contributes to India's natural wealth.
- The Indian peninsula boasts linguistic diversity with each state having its official language, including Tamil, Kannada, Telugu, Malayalam, Marathi, and Konkani. Hinduism is predominant, with significant Muslim and Christian populations, particularly in Kerala, Goa, Telangana, and parts of Andhra Pradesh, showcasing religious diversity.
- Coastal areas of the Indian peninsula thrive on cash crops like coconut, cashew nuts, and spices, supported by modern agricultural practices. The region is a hub for diverse industries, with Tamil Nadu excelling in automobile manufacturing, Bengaluru as the Silicon valley, and a well-established chemical and textile industry. The services sector, particularly in IT, contributes significantly to the region's economic growth, with Bengaluru and Hyderabad serving as prominent IT hubs. Additionally, tourism helps to boost the local economy in states like Kerala, Tamil Nadu, and Goa.
- Peninsular India's transport, shaped by ancient trade routes, features highways like the Golden Quadrilateral and railways like the Konkan Railway. Strategic airports, like Chennai International and Goa's Dabolim, leverage geographical advantages. Modernised waterways, using rivers such as Godavari and Krishna, facilitate maritime trade, with historical ports like Chennai and Kochi.
- India's islands, notably Andaman and Nicobar in the Bay of Bengal, showcases diverse geology with volcanic origins, limestone formations,

and seismic activity. The region's distinct physiography features rugged landscapes with high peaks like Saddle Peak, exceeding 2,400 metres, known for steep escarpments and dense forests.

- India's Andaman and Nicobar islands in the Bay of Bengal and Lakshadweep in the Arabian sea faces unique water challenges. Andaman relies on rainwater harvesting, while Lakshadweep uses collected rainwater for drinking. Sriharikota island depends on desalination and mainland supply, and Diu island uses desalination, dams, and reservoirs, emphasising efficient water management amid limited freshwater resources.
- India's islands have diverse climates. Andaman and Nicobar, in the Bay of Bengal, experience tropical maritime weather with high rainfall, warmth, and cyclone risk. Lakshadweep, in the Arabian sea, shares a similar climate with less rainfall. Sriharikota island has a tropical wet and dry climate, influenced by the mainland, with hot summers and cyclone potential. Diu island features a tropical wet and dry climate with sub-tropical traits, including hot summers and cyclone susceptibility. The islands' vegetation, shaped by geography, ranges from tropical rainforests to adaptive vegetation for semi-arid conditions, showcasing their ecological diversity.
- The Andaman and Nicobar islands showcases diverse settlements, including urbanisation in Port Blair and indigenous tribes in isolated regions. Economic activities are driven by fishing and tourism, while geographical constraints limit agriculture. Government employment, especially in defense, plays a crucial role. The islands rely on a well-developed transport infrastructure, with initiatives like the Lakshadweep Optical Fiber Cable Connectivity project aiming to enhance connectivity and foster economic development.

10.13 TERMINAL QUESTIONS

1. Discuss the relief of peninsular India.
2. Discuss the drainage and water resources of peninsular India.
3. Discuss the physical resource base of peninsular India.
4. Write a note on population of the islands of India.
5. Discuss the transport and communication of peninsular India.

10.14 ANSWERS

Self-Assessment Questions (SAQ)

1. The North Central Highlands, The South Central Highlands, The Chotanagpur Plateau, The Meghalaya-Mikir Uplands, The North Deccan (Maharashtra Plateau), The South Deccan, The Western Ghats or Sahayadri and The Eastern Ghats are the eight physiographic regions of Indian peninsula according to Prof. S. P. Chatterjee.
2. (i) Great Boundary Fault, (ii) Northern (iii) Lime Stone Formation (iv) Tamil Nadu Uplands

3. (i) T, (ii) T, (iii) F, (iv) F, (v) F
4. Major ports are Chennai, Mumbai, Kochi, and Vishakhapatnam.
5. Dudley Stamp, has divided Indian peninsula into 10 sub-divisions which are as follows: Coastal Region around the Plateau Proper, West Coast Region, Karnatak or Tamil Region (East Coast South), Northern Circars Region (East Coast North), Deccan Plateau, Deccan Lava Region, North-East Part of the Plateau, Central Indian Region, Rajput Upland Region and Thar or the Great Indian Desert.
6. Indian Plate and Burma Plate.
7. Lakshadweep Optical Fiber Cable Connectivity (LOFCC) project.

Terminal Question

1. Refer to sub-Section 10.3.2.
2. Refer to sub-Section 10.3.3.
3. Refer to sub-Section 10.3.7.
4. Refer to sub-Section 10.4.1.
5. Refer to sub-Section 10.4.4.

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GLOSSARY

Bangar : Bangar is the older alluvial floodplains.

Coniferous Trees : Trees found at higher altitudes that develop conical structures. For example, Pine and fir, etc.

Environmental Hazards : An environmental hazard is a substance, state, or event which has the potential to threaten the surrounding natural environment or adversely affect people's health.

GLOF : A glacial lake outburst flood is a flood caused by the failure of a dam containing a glacial lake. An event was similar to a GLOF, where a body of water contained by a glacial melt overflows causing loss of lives and property in the lower altitudes.

Kankar : Kankar is the nodular calcium carbonate of less than one centimetre to more than 5 centimetres in diameter.

Khadar : The Khadar soils are much more fertile as they are alluvial deposits. The Great Plain of India is divided into newer or younger deposits known as *khadar* while the older deposits are known as *Bhangar.*

Khadar : These are the low-lying flood plains of the alluvial plain.

Population Density : The number of populations living in a unit area is known as population density. It is also referred to as the man-land ratio. The density of the population is higher in urban cities as more population gets concentrated in a small geographical area.

Transhumance : Seasonal movement of animals from higher to lower altitudes during winter and lower to a higher altitude during summer season. For example, *Dokpas* in north Sikkim practice transhumance through the seasonal movement of Yaks to different altitudes.

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