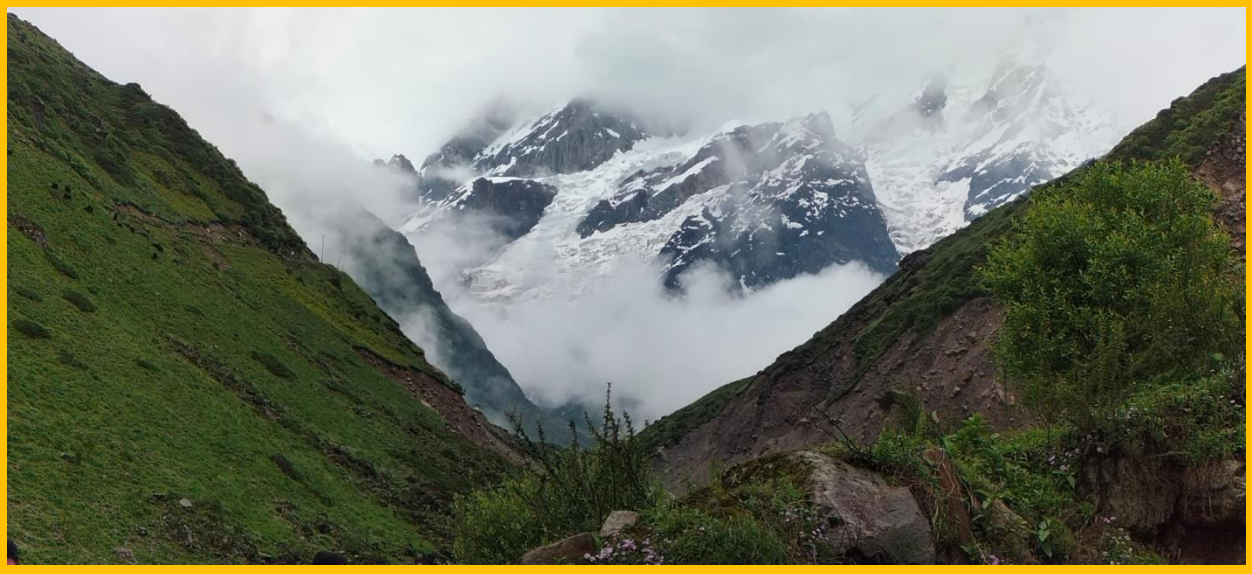
GEOG-503

GEOG-503 GEOGRAPHY OF INDIA

M.A./M.Sc. 1st Semester



DEPARTMENT OF GEOGRAPHY AND NATURAL RESOURCE MANAGEMENT

SCHOOL OF EARTH AND ENVIRONMENTAL SCIENCE
UTTARAKHAND OPEN UNIVERSITY
(Teenpani Bypass, Behind Transport Nagar Haldwani (Nainital) Uttarakhand)

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GEOGRAPHY OF INDIA

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BLOCK-1 GENERAL & PHYSICAL INTRODUCTION

UNIT 1: LOCATION AND EXTENT

1.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Understand the geographical, historical and cultural significance of India.
- Elaborate worldwide situation of the country, its location and size extent.
- Describe the land and water boundaries of India.

1.2 INTRODUCTION

India is a vast country of diversity, multiformity and enchantment. According to ancient scripture The'Vishnu Puran', north of the sea (Indian Ocean) and south of 'The Himalaya' is called 'Bharat' and the people residing are called 'Bhartiya'.

Uttarmyatsamudrashyahimadreshchaivdakshinam |

Varsh tad bharatm naam bharatee yatra santati ||(Vishnu Puran)

India has been the center of attractiveness of the world since time immemorial. It is one of the oldest civilization and culture. The country is a locale of South Asia Continent. Earlier the whole region (South Asia Continent) is known as "The Indian Sub-continent" in Colonial Period. Inspite of having mass extent, there has been unity in diversity. The country is a dazzling land of different religions, traditions, languages and landscapes. The reason behind of such a wide diversity is its geographical condition. India spread from the Great Himalayan range in the north to the massive Gangetic plains, the arid Thar deserts of Rajasthan, the lush-green Western Ghats, and the fascinating coastal regions. This each part encompasses distinct flora and fauna. Despite of having such wide diversity, India has embraced the integrity in core ethos.

Such enormous diversity is rare in any other region of the world. Well said by **Nag & Sengupta** that India is a concept and an experiment through ages. India is an exceptionand it has no parallel exists.**Prof. Chisholm** has rightly said that there is no part of the world better demarcated by nature as a region by itself than the Indian sub-continent. The cultural life of India is also a symbol of its fundamental unity. It has been the meeting place of many castes and religions since ancient times. Due to the arrival of different castes, the contact of many civilizations and the mutual exchange of different ideas, Indian culture was formed and there was no difference in its basic soul. FiraqGorakhpuri has rightly said-

Sar-zamiin-e-Hind par aqvaam-e-aalamke 'firaaq'

Qaafile baste gayeHindostaanbantaagayaa

Therefore, it can be said that due to the difference in the physical structure,vegetation and climate of a vast country like India, there is extreme disparity in produce, animals, birds, human

living, costumes, food and customs from one region to another are found but all are bound to a particular culture.

1.3 NOMENCLATURE

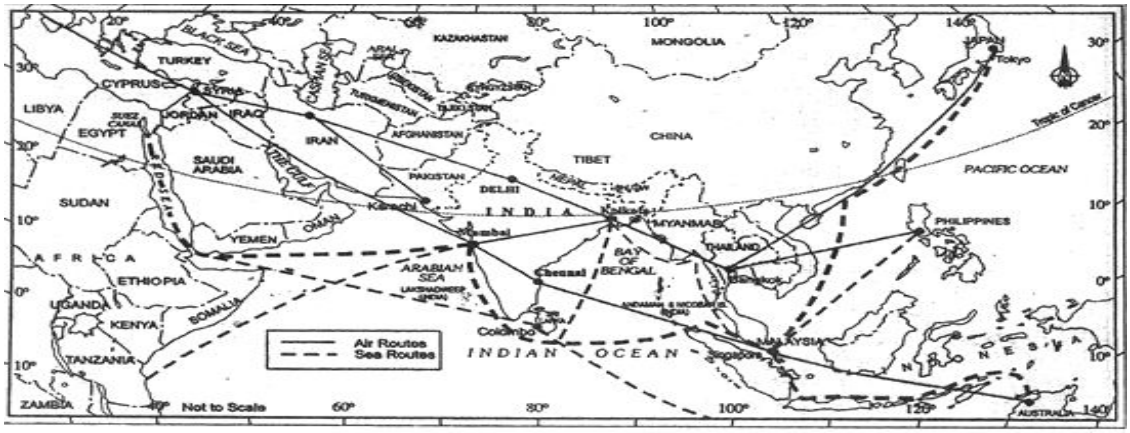
Rigveda was the abode of the Aryans in the Vedic period, the five tribes of India i.e. Bharat, Trishu, Anu, Drahuu and Yadu, who envisioned this fundamental unity.This area was named Bharat after the name of the head of a powerful people of these Aryans. According to the Vayu Purana, this region was named Bharat after the name of Bharata, the son of King Dushyant and Shakuntala. According to Jain religion, the region was called Bharat after Bharata, the son of its first Tirthankara, Rishabhdev. In the Buddhist period, this area was to be known as Jambudweep. The area which was ruled by Arya in the Vedic period. At present, the word oriental was used for Punjab, Haryana, Western, Uttar Pradesh and non-Aryan ruled areas are called as Prachya (Magadha, Videh).Being the land of Aryans, it came to be known as Aryavarta or Brahmavarta. Whose position was between the Vindhyachal Mountains and the Himalayas. Dakshinapatha was situated between Vindhya Mountain to Krishna River and Tamil Nadu was situated to its south.Later, the entire area from Kashmir to Kanyakumari came to be known as Aryavrat.The Indus River represents this subcontinent to the outside world. The words India, Hindu and Hindustan have originated from the name of this river. The Romans called this river the Indus. The etymology of the word India is believed to be from the area near the Greek word Indoi; Indus. Arabs abs Iraninsuttered's' as 'h' and called this Hindu and gave the name Hindustan to this state.Ancient India was the center of world trade as it was at the forefront in the export of food items, cotton, gems, diamonds, etc. Due to the abundance of wealth, India was also called the golden bird.Presently India is officially known as the Republic of India.

1.3.1 LOCATION

The location of India is found in the Northern and eastern hemisphere of the world. Its latitudinal extent is from $8^{\circ}4'$ north to 37º6' North and longitudinal extent is from 68º7' East to 97°25' East. The actual extension of the southern part of India is found up to 6º45' North latitude,i.e. the last southern island of the Nicobar Islands. This southernmost point is known as Pigmeliyan Point or Indira Point.Its longitudinal extension is about 30 degrees therefore, after dividing it into two parts, the longitude of 82º30' East is found in centre and has been considered as the Standard Meridian for the construction of Indian Standard Time (IST). It is 5 hours 30 minutes ahead of Greenwhich Mean Time (GMT) i.e., if it is 12:00 noon in Greenwich (London), then in India it will be 5:30 in the evening. Due to the large longitudinal extension, morning in Gujarat is delayed by 2 hours as compared to Arunachal Pradesh. As a result, in the same way, due to its greater latitudinal expansion between the Northern and Southern region, there is a considerable variation in the length of day and night and rainfall,temperature, vegetation and leaving conditions in Kerala and Ladakh as well. The Tropic of Cancer passes through the middle of the country which divides it into two parts, the northern temperate zone and the southern tropical

zone. The Tropic of Cancer passes through eight states of India –i.e.Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram.

Fig 1.1: India's Location in South Asia and International Trade routes.



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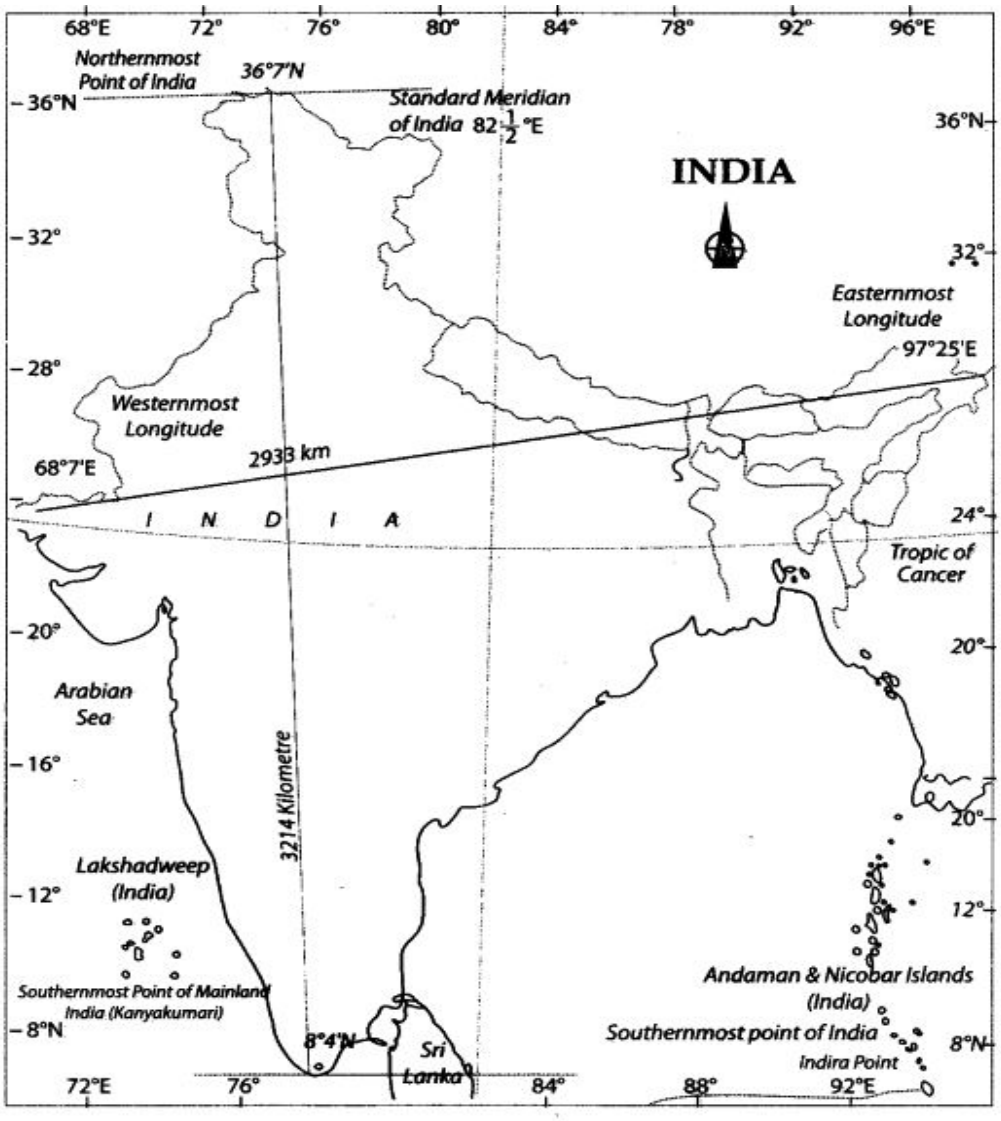
The location of India is in the north of the Indian Ocean and the Indian peninsula divides it into two water areas, the Bay of Bengal in the east and the Arabian Sea in the west. India is the only unique country to have an ocean named after it i.e., the Indian Ocean on whose bridge 46 countries are located. Due to its presence on the northern end, many sea routes pass through the coast of India. About 6100 kms,coastal line has played an important role in the countries international trade and in connecting socio - cultural contacts with the people of the Middle East, South East Asia and East Asia. Major trade routes from eastern countries to Western countries and from Western countries to far East past through India. With the construction of Suez Canal, the importance of India's position has increased much more. Also, due to the construction of Suez Canal the distance between India and Western European countries has been reduced by 4800 kms,hencethere has been a lot of reduction in both time and distance of freight. The Suez Canal and the Strait of Malacca are the busiest waterways of the world through which about 20,000 ships pass every year. India's central location in the developing countries of Asia and Africa, gives it a unique advantage of playing an important role in the trade, technological development and economic development of third world countries. Airlines going from the West and the Middle East to China, Japan, Indonesia,Australia and New Zealand pass through India only. Delhi, Mumbai, Kolkata, Chennai and Thiruvananthapuram are airports of international importance where aircraft stop for refueling.

India has many advantages of its terrestrial situation. This gives rise to different types of climate which is responsible for the development of many types of Flora and Fauna. The position of the Northern Himalayas protects it from the cold winds coming from Siberia in winter and irrigates it by stopping the monsoon winds. The eternally watery rivers coming out of the

Himalayas provide it with water throughout the year. The Himalayas have prevented attacks and intrusions from the north since ancient times and trade was done with China and Tibet through its pass. At that time, India was the centre of major trading routes from where Indian merchant sold various types of valuable items such as hot spices, pearls, diamonds, gold, silver,gems, silk clothes etc. to the Eastern countries like China, Myanmar, Thailand,Cambodia, Sumatra, Bali,Java and Western countries like Arab,Persia, Egypt, Greek and Roam. The empires of Chola, Pandya, Pallava etc. in South India established their colonies in eastern countries where, even today, a glimpse of Indian culture is found. Thus, from the international trade point of view, the geographical location of India has been remained important since ancient times.

Fig 1.2: Location and extent of India



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1.3.2 SITE & SITUATION

India is a country in terms of expansion.The total geographical area of India is 32,87,263 square kilometers, which is 0.57% of the globe area and 2.4% of the area of the lithosphere.In terms of area, India is the seventh largest country in the world after Russia (1,70,75,400 km^2), Canada (99,70,610 km^2), Chine (95,72,900 $km^{2)}$, USA (93,72,610 km^2) , Brazil (85,11,996 km^2) and Australia (76,82,300 km^2).Its extent is 14 times that of Great Britain, 9 times that of Japan, 45 times that of Sri Lanka, but it is one-third of Canada and one-fifth of Russia. In terms of population, India is the second largest country in the world after China. About 16.2% of the world's population resides in India. The northernmost point of India is Indira Col (Jammu & Kashmir), while the southernmost point is Cape Comorin (Kanyakumari, Tamilnadu), the southernmost point away from the mainland is Indira Point (Andman and Nicobar Islands). The eastern Point of India is Kibithu (Arunachal Pradesh), while the western point is Gohar (Gaur) Moti (Sircreek, Gujrat).

The shape of India is not entirely triangular but quadrangular, which is so well delimited by nature on all sides except the southern parts, as probably no other country. The extent of India from north to south is about 3220 kms and from east to west it is about 2933 kms. There is a difference of only 281 kilometers between the two. Its northern and north-eastern boundaries are defined by mountain ranges while the entire southern boundary is by the Indian Ocean. Andaman and Nicobar Islands and Lakshadweep are located off the mainland in the Bay of Bengal and the Arabian Sea respectively. Its extreme southern part is about 876 kms away from the equator. India is bordered by Pakistan and Afghanistan in the west, China, Nepal and Bhutan in the north and Myanmar and Bangladesh in the east. In the south, it is separated from Sri Lanka by the Palk Strait. The length of the land border of India is 15200 kms while the length of the coastal border is 6100 kms. If the coast line of the islands is also included in this, then it becomes 7517 kms. The drawbacks of this peculiar shape are especially seen in two regions - first, the north-western region - here the Union Territories of Jammu and Kashmir and Ladakh are separated from the rest of the country by high mountain ranges, but this region is connected to the country by only one road and only one railway track. Second, the eastern region – this region is connected to the rest of the country by only a 24 km wide land corridor between Bangladesh and Nepal, through which passes a rail line and road connecting the north-eastern states.

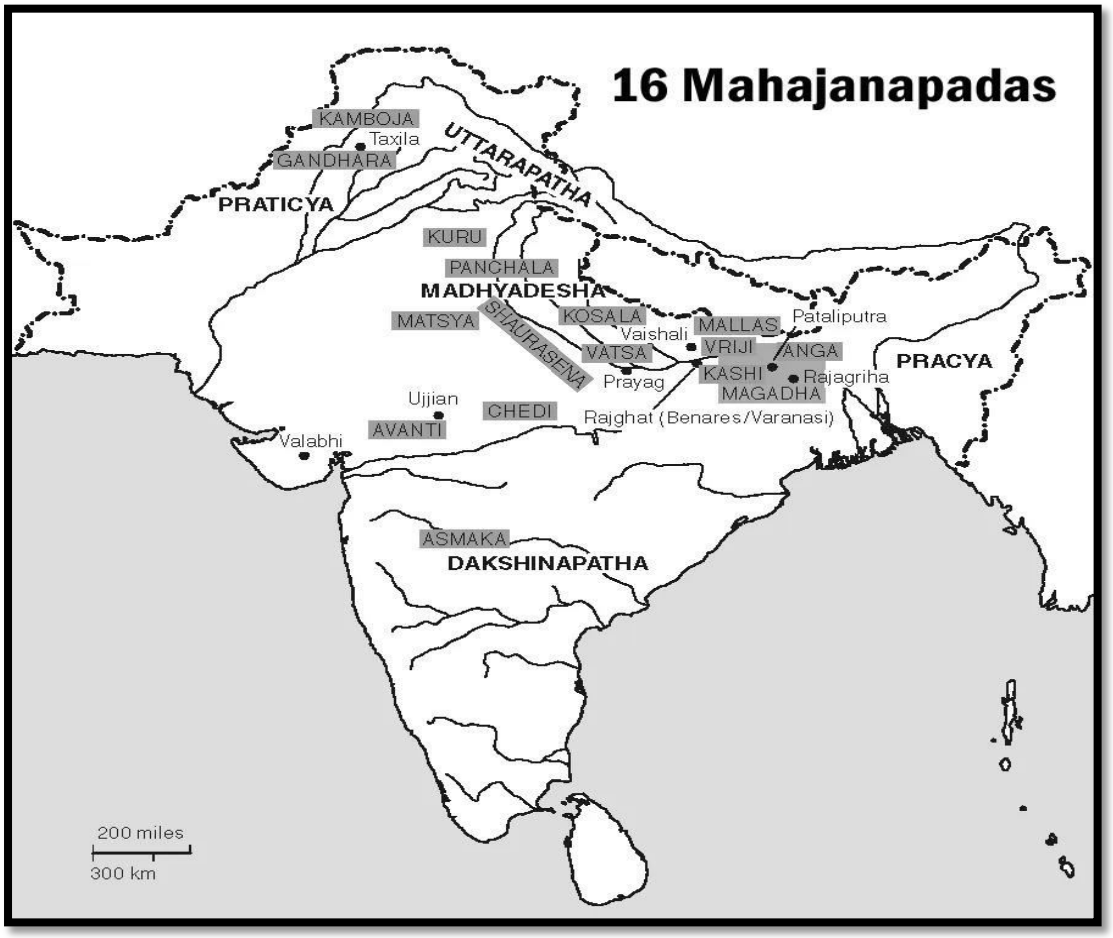
1.3.3 HISTORICAL-POLITICAL INTEGRATION

Due to the Paucity of Archaeological studies, very little is known about the political organization of India in prehistoric and proto-historic times. Generally, the ancient period from the beginning to the 6^{th} century is accepted as the early period, the early medieval period from the 6^{th} to the 13^{th} century, the medieval period from the 13^{th} to the 18^{th} century and the modern period from the 18^{th} century to present.

1. The Ancient Period- According to some historians, Aryans were originally residents of India and their contribution in the development of Indus Valley civilization was substantial. But there is ample evidence that the Aryans, this area was inhabited by Dravidians, who contributed significantly to the development of the Indus Valley Civilization. The remains of the Indus Valley civilization have been found in Hadappa, Mohanjodado (Pakistan), Kalibangan, Rupad and Lothal (India). Around 2000 BC, the Aryans made their first colonies in the Saptsindhu (Punjab) region. Gradually, their rule spread from the entire Himalayan Mountains to the Vindhyanchal Mountains. In the Vedic Period, Emperor Bharat established a huge empire by combining the territories of many small Aryans and Non-Aryans kings, whose expansion was from Afganistan in the west to Myanmar in the east and from Nepal and Southern Tibet in the north to Tamilnadu in the south. The country was divided into five major regions namely Udichya (Afganistan and Northern Pakistan), Pratichya (Rajsthan and southern Pakistan), Madhyadesh (Punjab and Western Uttar Pradesh), Prachya (Eastern Uttar Pradesh, Bihar, Bengal Assam and Odisha) and Dakshinapath (Southern India). According to V S Agrawal, the period from 1000 BC to 500 BC is known as MahajanpadPeriod . Out of these 16 Janpadas- Ang, Magadh, Kashi, Kaushal, Matshya, Vajji, Mall, Vatsa, Chedi, Kuru, Panchal, Sursen, Avanti, Ashmak, Gandhar and Kamboj were famous in Buddhist Period.

In 600 BC, the vast empire of Magadh was established by joining many Janapadas of Northern India. After driving out the Greek Governors, Chandragupt Maurya took control of Gandhar, Sindh and Punjab. The Magadh Empire reached its zenith during the reign of Ashok-The Great in 232 BC. The entire subcontinent became a part of the Maurya Empire, except for the Chola's, Pandaya's and Tamra-pani ruled areas in the south. After the death of Ashoka, the Mauryan empire disintegrated into smaller states, due to which Greek, Saka and Kushan attacks got which spread from Kapisa, Gandhar (Afganistan) and Kashmir to pataliputra (patna), whose capital was located inpurushpur. After the disintegration of the Kushan Empire in 360 AD, India was again divided into small states. The Gupta period (320-510) is called the Golden age of India. During the reign of Chandragupta Vikramaditya (375-413 AD), the entire region from the Himalayas to the Narmada and from Gujrat to Bengal was a part of the Gupt Empire. The Mahakaushal, Vakataka, Pallava's, Chola's and pandya's states of the south also loyal to the Gupta rule even though they were independent. Chinese traveler Fahiyan came to India during this period.

Fig 1.3: Presentation of Mahajanpadas.



Source: Google Imagery

2. The Early Medieval Period- The invasion of Hudas in the 6th century brought an end to the Gupta Empire and the country was again divided into smaller states.Harshvardhan (606-647 AD) again established a strong empire in Northern India by joining them, whose extent was found from Himalayas (including Nepal), to Narmada. At this time, the Kingdoms of Chalukya, Kalinga, Cholas, Pandyas etc. we're expanding in Southern India. Chinese traveler Hwensangcame to India during this period, whose travel detailed information about the country's political, social, cultural and economic conditions. After Harshvardhan, a triangular stuggle started between the 8th to 10th centuries between the Pratiharas of Jalaur, the Palas of Bengal and the Rashtrakutas of Dakkan for the supremacy of this region. Due to this, during the 11th and 12th centuries, the turks got a golden opportunity to attack India. In 1120 AD, Mohammad Gauri established a Muslim state in India by the last Rajput ruler of Delhi Pritiviraj Chauhan.

Fig 1.4: Gupta Empire.

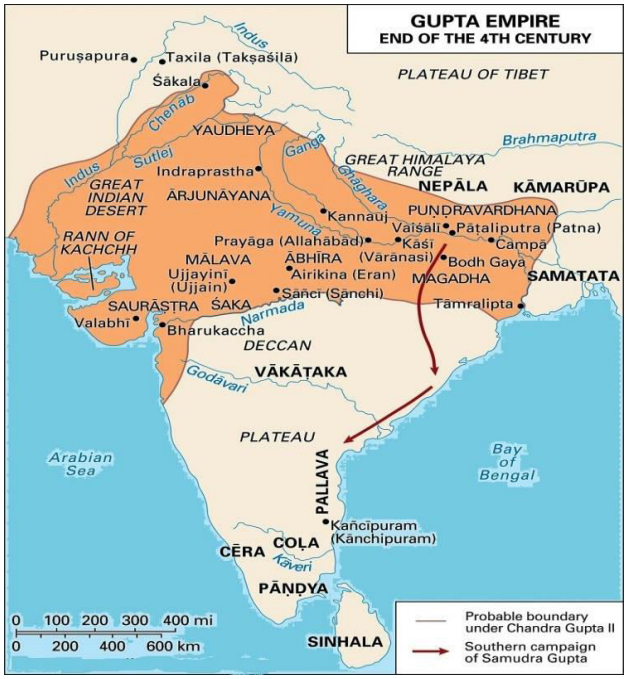


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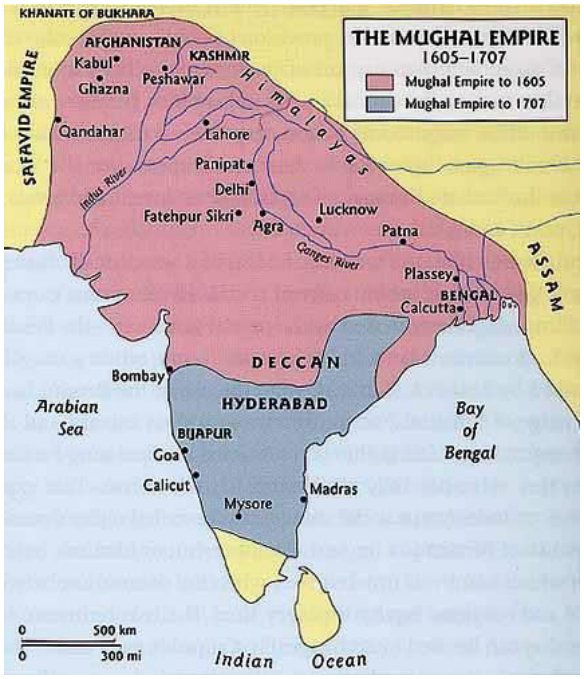
Fig 1.5: The Mughal Empire



Source: Google

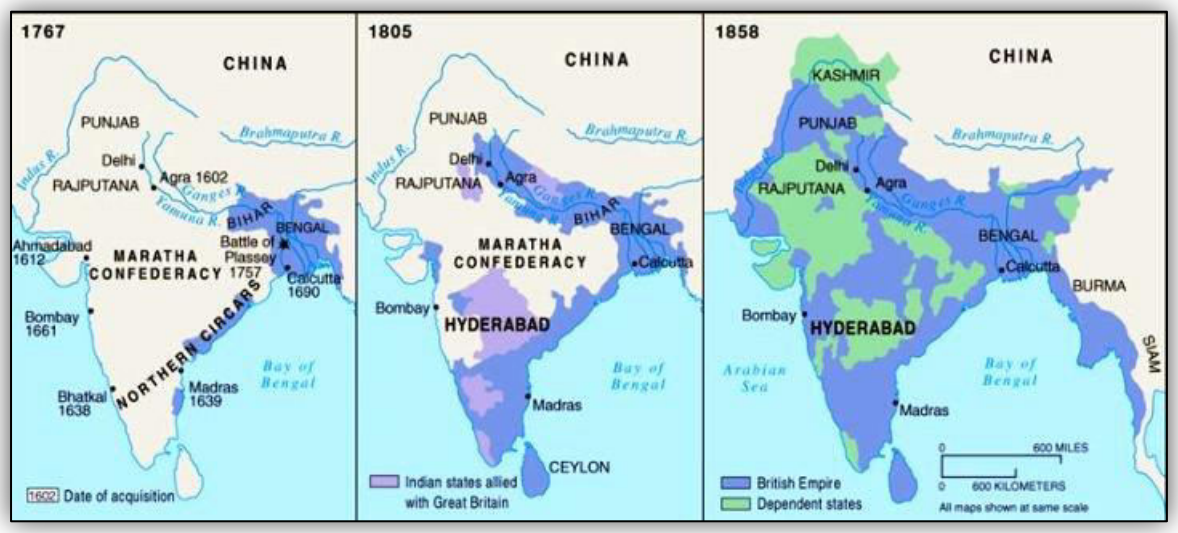
3. The Medieval Period – In the beginning of this period, Delhi was ruled by the Gulam (1206-1290 AD), Khilaji (1290-1320 AD), Tuglaka (1320-1414 AD), Saiyyad (1414-1451 AD) and Lodi (1451-1526 AD) Muslim dynasties respectively. In 1526 AD, Sultan Babar of Kabul established the Mugal dynasty by defeating Ibrahim Lodi. Akbar re-established a vast empire on the subcontinent which extended from Odisha to Kabul and from Kashmir to Ahamadnagar. During this period, the country's prosperity increased due to peaceful environment, central administration and uniform revenue policy increase in internal and external trade etc. Vasco-de-gama discovered the sea route to India 1498 AD. British (1600 AD), Dutch (1602 AD) and French (1604 AD) East India Company were established during the reign of Akbar. After the death of Aurangzeb (1707 AD), the Marathas became powerful due to the decrease in the power of the Mugals. The humiliating defeat of the Marathas by Abdali in 1761 AD paved the way for British colonial rule. By the end of 18th century, the British had control over Tanjore, Surat, Karnataka and Awadh.

4. The Modern Period –After the first independence war in 1857, the Britishers became the undisputed rulers of the country. During this, the entire region of India, Pakistan and Bangladesh became a part of British India. They administered by dual political system: First, 12 provinces directly administered by British governors, and Second, 584 princely states under indigenous kings, whose administration was done on the advice of the British Resident. The Indian Independence Act created 564 independent countries instead of liberating these princely states,

in which India and Pakistan had Dominion status. In theory this left India more fragmented than before the arrival of the Britishers. Due to the efforts of Sardar Ballabh Bhai Patel, these princely states could be peacefully merged into the Indian Union. The work of integration of India was completed within one and half years of independence. As a result, the number of states decreased from 571 to 27 on 26 January, 1950.

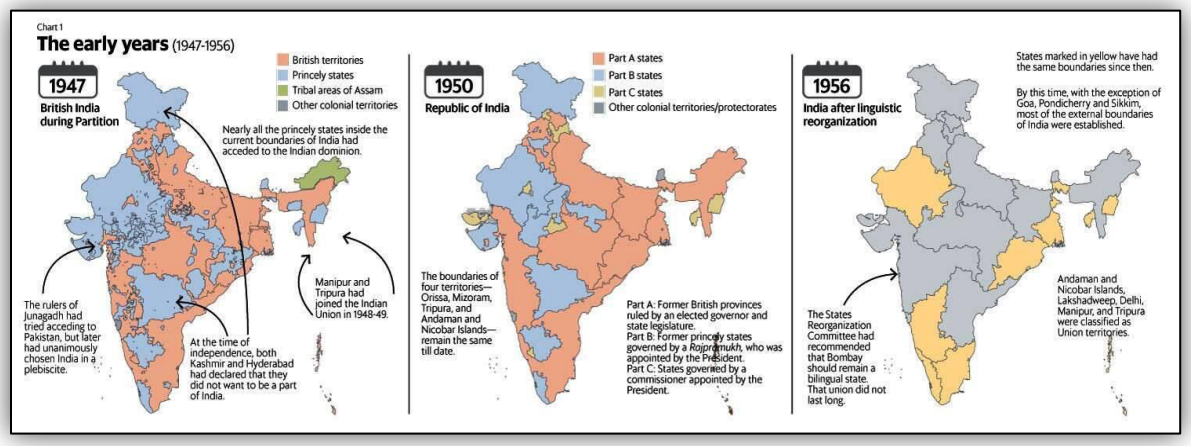
The boundaries created by combining the old provinces and princely states were inconsistent with the economic, administrative, linguistic and cultural point of view. Which results, Aandra Pradesh was first formed as a Telugu-speaking state in 1953 on the basis of language. The State Reorganization Commission was established on 29 September, 1953. This commission submitted its report on 30 December, 1955. It made language the basis of reorganization of states, nationalintegration, administrative and financial viability, economic development and protection of minority interests. The government accepted its recommendations with some changes. The States Reorganization Act was passed by the parliament on 01 November, 1956, in which the two-tier system of the states was approved : First, 14 big states (Aandra Pradesh, Assam, Bihar, Bambai, Jammu Kashmir, Kerala, Madhya Pradesh, Madrash, Mysore, Odisha, Punjab, Rajsthan, Uttar Pradesh and West Bengal) with elected assembly and governor as administrative head, and Second,

Fig. 1.6: British India at 1767 AD, 1805 AD & 1858 AD



Source: Google Imagery

Fig.1.7 Modern India at 1947 AD, 1950 AD & 1956 AD



Source: Google Imagery

06 (Delhi, Himanchal Pradesh, Manipur, Tripura, Andman&Nikobar, Lakshadweep and Minicoy Islands) Union Territories under the direct rule of the Center by the Lieutenant Governor. On 01 May, 1960, the bilingual state of Bambai was divided into the states of Maharashtra (Marathi) and Gujrat (Gujrati) on linguistic grounds. On 18 December 1961, Goa, Daman & Diu were freed from Portuguese rule and given the status of Union Territory. On 01 November 1966, Punjab was divided into two states named Punjab and Haryana and Chandigarh was made a Union Territory (1970). In 1970, Himachal Pradesh was given full Statehood. On 02 April 1970, the state of Meghalaya war formed by merging the Garo, Khashi and Jaintia districts of Assam. Thereafter, the North Eastern Region was divided into 05 states (Assam, Meghalaya, Manipur, Tripura and Nagaland) and 02 Union territories (Arunachal Pradesh and Mizoram) by the North Eastern Reorganization Act, 1971. On 26 April 1975, the protectorate of Sikkim was made the 22nd state of the country. Similarly, Mizoram (23.06.1986), Arunachal Pradesh (08.12.1986) and Goa (11.05.1987) became the 23rd, 24th and 25th states of the country by constitutional amendment. In the Year 2000, the states of Chhattisgarh (02.11.2000), Uttarakhand (09.11.2000) and Jharkhand (15.11.2000) were formed by dividing Madhya Pradesh, Uttar Pradesh and Bihar respectively. On 02 June, 2014, the state of Telangana was carved out of Andhra Pradesh. On 31 October, 2019, The Jammu and Kashmir Reorganization Act of 2019 transformed Jammu and Kashmir into the new Union Territory of Jammu & Kashmir and the new Union Territory of Ladakh. Ladakh is divided into two districts : Kargil and Leh. Recently, Parliament passed the Dadra and Nagar Haveli and Daman-Diu (Merger of Union Territories) Bill, 2019 to merge the 02 Union Territories of Dadra and Nagar Haveli and Daman and Diu on December 03, 2019. Hence, on the occasion of71st Republic Day (26.01.2020), Union Territories of Dadra-Nagar Haveli and Daman-diu came into existence. Thus, at present, a total of 28 states and 08 Union Territories are included under the Indian Union.

Table-1.1: State/Union Territories – Population and Other Characteristics 2011.

State/ Union Territory	Capital	Area in Km^2	Population	Density ($p/km^{2)}$	Literay Rate	Sex Ratio	Main Language
Aandra Pradesh.	Amarawati	160205	49471555	308	67.7	992	Telugu
Arunachal Pradesh.	Itanagar	83743	1383721	17	65.4	938	Tribe Language
Assam	Dispur	78438	31205576	398	72.2	958	Assamese
Bihar	Patna	94163	104499452	1106	61.8	918	Hindi
Chhattisgarh	Raipur	136034	25545198	189	70.3	991	Hindi
Goa	Panji	3702	1458545	394	88.7	973	Konkad, Marathi
Gujrat	Gandhi Nagar	196024	60439692	308	78.0	919	Gujrati
Haryana	Chandigarh	44212	25351462	573	75.6	879	Hindi
Himanchal Pradesh	Shimala	55673	6864602	123	82.8	972	Hindi
Jharkhand	Ranchi	79714	32988134	414	66.4	949	Hindi
Karnataka	Bengluru	191791	61095297	319	75.4	973	Kannada
Kerala	Thiruvananthpuram	38863	33406061	860	94.0	1084	Malyalam
Madhya Pradesh	Bhopal	308000	72626809	236	69.3	931	Hindi
Maharashtra	Mumbai	307713	112374333	365	82.3	929	Marathi
Manipur	Imphal	22327	2570390	115	79.2	992	Manipuri
Meghalaya	Shilong	22429	2966889	132	74.4	989	Khasi, Garo, English
Mizoram	Aizawal	21081	1097206	52	91.3	976	Mizo, English
Nagaland	Kohima	16579	1978502	119	79.6	931	Angami, English
Odisha	Bhuvneshwar	155707	41974218	270	72.9	963	Oriya
Punjab	Chandigarh	50362	27743338	551	75.8	895	Punjabi
Rajsthan	Jaipur	342239	68548437	200	66.1	928	Hindi
Sikkim	Gangtok	7096	610577	86	81.4	890	Lepcha, Bhutiya
Tamilnadu	Chennai	130058	72147030	555	80.1	996	Tamil

Telangana	Hyderabad	114840	35193978	312	66.4	988	Telgu, Urdu
Tripura	Agartala	10492	3673917	350	87.2	960	Bengali, Kakborak
Uttar Pradesh	Lucknow	238566	199812341	829	67.7	912	Hindi
Uttarakhand	Dehradun	53484	10086292	189	78.8	963	Hindi
West Bengal	Kolkata	88752	91276115	1028	76.3	950	Bengali
Andman&Nikobar Island	Port Blair	8249	380581	46	86.6	876	Hindi, Nikobari
Chandigarh	Chandigarh	114	1055450	9258	86.0	818	Hindi, Punjabi
Dadra & Nagar Haveli and Daman &diu	Daman	603	585764	970	81.65	704	Hindi, Gujrati
National Capital Territory of Delhi	Delhi	1483	16787941	11320	86.2	868	Hindi
Jammu & Kashmir	Srinagar, Jammu	163090	12267013	75	67.16	889	Kashmiri, Dogari, Urdu
Ladakh	Leh	59146	274289	5	73.5	750	Ladakhi, Purgi
Lakshdweep	Kavarati	32	64473	2149	91.8	947	Jeseri, Mahal
Pudducherry	Pudducherry	492	1247953	2547	85.8	1037	Tamil, Telgu
India	**New Delhi**	**3287782**	**1210569573**	**382**	**73.0**	**943**	**Hindi, English**

Source: Census of India and google.com

Even after attaining independence, many changes are seen in the administrative body in India. As per census of 2011, the population of India is 1,21,05,69,573. On the basis of population, India ranksecond in the world after China. Uttar Pradesh (19,98,12,341) is the largest state of India on the basis of population. The population of Uttar Pradesh is equal to that of Pakistan which is the sixth largest country in terms of population of the world and is more than that of Bangladesh and Japan. After this Maharashtra (11,23,74,333) and Bihar (10,44,99,452) come in second and third place respectively. While Sikkim (6,10,577), Mizoram (10,97,206) and

Arunachal Pradesh (13,83,727) rank first, second and third respectively in the lowest population. Among the Union Territories, NTC of Delhi (1,67,87,941) has the highest population and Lakshdweep (64,473) has the least population.

According to the 2011 census, the total population density of the country is 382 persons per sq km. Arunachal Pradesh is the state with the lowest population density (17 persons per sq km) and Bihar (1102 persons per sq km) is the state with the highest population density. Among Union Territories, Delhi has the highest population density (11,320 persons per sq km) and Ladakh has the lowest population density (5 persons per sq km). Bihar is followed in descending order by West Bengal (1028), Kerala (860), Uttar Pradesh (829) and Haryana (573).

The literacy in the country is 73.0 percent. Which is 14 times the literacy of 1901 (5.53%) and 4 times the literacy of 1951 (18.33%). Kerala has the highest literacy rate (94.00%). It is followed by Lakshadweep (91.80%), Mizoram (91.30%), Tripura (87.20%) and Goa (88.70%). Bihar (61.8%) is the most backward state after Arunachal Pradesh (65.40%) , Rajasthan (66.10%), Jharkhand (66.40%), Telangana (66.40%), Andhra Pradesh (67.70%) and Uttar Pradesh (61.7%) in terms of literacy. The sex ratio in India, as per 2011 census, is 943. Kerala has the highest sex ratio of 1084 while Haryana has the lowest of 879.

India is Land of Diversity

India is indeed a land of diversity, and this diversity manifests in various aspects of the country, including its geography, culture, language, religion, and people. Here's an explanation of the diversity found in India:

1. Geographical Diversity: India boasts a wide range of geographical features, including towering Himalayan Mountains, vast plains, arid deserts, lush rainforests, coastal regions, and numerous rivers. This diverse landscape has influenced the climate, flora, fauna, and even the lifestyle of people living in different regions. While in the north there are high peaks and deep valleys with steep slopes, in the south there are flat mountains with eroded relief and broad valleys. A flat fertile plain with uniform relief is spread between these two. India is have theworld's second highest peak (k2 8811 m) as well as the Sunda Trench (depth 7000 m) in the Indian Ocean. Although the climate of India is mainly called tropical monsoon climate, but there is a lot of heterogeneity in it at the micro-regional level. While the temperature of Leh drops to -45 degree centigrade in winters, the temperature of Ganganagar (Rajasthan) rises to 50 degree centigrade in summer season. In summer, low air pressure is found in the northwestern part of India and high air pressure is found over the Indian Ocean region. In the winter season, opposite air pressure and air flow sequence is observed and the weather is generally dry. In the northern plains, the amount of rainfall gradually decreases away from the coast from east to west. But in the peninsular south, the order of decline is seen from west to east. But in the peninsular region in the south, the order of decline is visible from west to east. Mawsynram (near Cherrapunji) is

the place with the highest rainfall (1141.9 cm) in the world, while Phalodi (Rajasthan) receives less than 25 cm of annual rainfall (only 3.99 cm of rainfall in 1899 AD). About 30,000 species of plants are found in the country, which belong to gymnosperm and angiosperm classes and are divided into about 174 natural classes. There is considerable variation in soil types also, where the Chika soil of Bengal and Assam is suitable for rice and jute crops, the alluvial soil of Punjab and Uttar Pradesh for wheat crop, the black soil of Maharashtra for cotton, the soil of the coastal region for coconut and the soil of mountain slopes is helpful in the production of tea and coffee crops.

2. Linguistic Diversity: India is home to a staggering number of languages. While Hindi (43.63%) and English (0.02%) are the official languages at the national level, there are 21 officially recognized regional languages. Additionally, there are over 1,600 other languages spoken throughout the country, including Tamil (5.70%), Bengali (8.03%), Telugu (6.70%), Marathi (6.86%), Gujarati (4.58%), Urdu (4.19%), Kannada (3.61%), Odia (3.10%), Malyalam (2.88%), Punjabi (2.74%), Assamese (1.26%) and many more.

3. Cultural Diversity: India's cultural diversity is captivating. Each region has its own distinct traditions, customs, art forms, music, dance, and cuisine. From the vibrant festivals of Diwali, Holi, Lohari, Christmas, and Eid celebrated across the country to the diverse wedding rituals and attire, every aspect of Indian culture reflects the rich diversity of its people.

4. Religious Diversity: India is the birthplace of major world religions such as Hinduism, Buddhism, Jainism, and Sikhism. Additionally, there are significant populations of Muslims, Christians, Jews, and other religious communities. This religious diversity coexists, often resulting in the presence of places of worship for different faiths in close proximity. Their methods of worship include animism, mysticism, monotheism, dualism, polytheism and even atheism, which can be seen in the form of Hindu (79.80%), Muslim (14.23%), Christian (2.30%), Sikh (1.72%), Jain (0.70%), Buddhist (0.70%) and other religions (0.66%). This is the reason why one can easily see Temples, Mosques, Churches, Gurudwaras etc. anywhere in the country.

5. Ethnic Diversity: India is home to a wide range of ethnic groups and communities. The population includes indigenous tribes, as well as people of Dravidian, Indo-Aryan, Mongoloid, and various other ethnic backgrounds. This diversity is evident in the physical appearances, traditions, and cultural practices of different groups.

6. Socio-economic Diversity: India's socio-economic diversity is immense, with significant variations in income levels, education, occupations, and living standards. There are rural agrarian communities, bustling metropolitan cities, and everything in between. This diversity in socio-economic backgrounds contributes to the tapestry of Indian society. The distribution of population of India is also not uniform. Nearly half of the country's population resides on only 22% area of it, while half of the country's area feeds only a quarter of the population. 31.2% of

the country's population lives in cities and 68.8% in rural areas. Wherein, there are 7,935 urban centers of different sizes and 5,93,732 villages of the country of different size, constitution and size. The labor force is 30% of the total population, of which 70% is engaged in agriculture, 10.7% in industries and 5.6% in trade and commerce. On the one hand, there are modern large scale industries, which use the latest technology to produce quality goods for the international market, and on the other hand, cottage, small and household industries predominate in rural areas and small towns.

7. Political Diversity: India is a federal parliamentary democratic republic, with 28 states and 8 union territories, each with its own legislature and government. This decentralized political structure allows for local governance and decision-making, accommodating regional aspirations and concerns.

Overall, India's diversity is a source of strength and richness, providing a multicultural and multi-dimensional experience. It has shaped the country's history, influenced its art and architecture, and contributed to its economic and social fabric. The coexistence of various cultures, languages, religions, and traditions has given rise to a vibrant and pluralistic society, making India a truly remarkable and diverse nation.

1.3.4 INDIA- INTERNATIONAL BOUNDRIES & FRONTIERS

The boundaries of a country are determined by its natural set-up, historical and cultural conditions, its history, ethos, customs, traditions and nature. India's boundary line in the world is calculated in large boundaries. The Himalayan mountain range in the north, the Arabian Sea in the southwest, the Bay of Bengal in the southeast and the Indian Ocean in the south form the natural boundaries of India. India's international boundaries are of both land and water.

1. Land Boundaries -India's land borders are Nepal, Bhutan and China in the north, Bangladesh and Myanmar in the east and Pakistan in the west. The border of Afghanistan also touches the country on the northwestern border of Kashmir. The length of India's land border is 15200 km. India's longest land border with Bangladesh is 4096.7 kms while the shortest border is with Afghanistan of 80 kms.

Table-1.2: Length of India’s Border with the neighboring countries.

Sl. No.	Name of the Country	Length of Border in Km.	Percentage of total Length

			of Border
1.	Bangladesh	4096	26.95
2.	China	3917	25.77
3.	Pakistan	3310	21.78
4.	Nepal	1752	11.53
5.	Myanmar	1458	9.59
6.	Bhutan	587	3.86
7.	Afghanistan	80	0.52
	TOTAL	**15200**	**100.00**

Source:Rajneetikbhoogol, Harimohansexena

A. India-Bangladesh Border-The entire boundary line between the two countries is terrestrial. It is bordered by the five Indian states of West Bengal, Assam, Tripura, Meghalaya and Mizoram. India shares the longest international border with Bangladesh which is 4096.7 kms. It is 26.95% of the total land border of India. It is also known locally as Radcliffe Line (IB). Also it is the fifth longest land border in the world. Most of the disputes along this border have been resolved amicably, but a large number of infiltrators sneaking in from Bangladesh have created several problems related to population composition, regional tension and internal security in the North-Eastern states, especially Assam, have created problems. India has started installing 8 feet high barbed wire across the border to control illegal infiltration and smuggling in this area. The government had initially sanctioned the 3406 kms run along the India-Bangladesh border. According to a Government of India press release, the sanctioned length of the fence along the Indo-Bangladesh border was 3326.14 kms, as against 2747.44 kms as of February 2018. Till July 2019, 2803.01 kms fencing was completed and till August 2021, 3141 kms fencing was completed. As per the agreement signed on 31 July 2015, 111 enclaves of India were handed over to Bangladesh and 51 enclaves to India. The residents of these settlements were exempted, in which more than 50,000 citizens of both the countries would be able to reside within the geographical boundaries of their respective countries.

B. India-China Border - There is about 4057 kilometers border between India and China. Which has been determined in a tripartite conference held in Shimla in 1914, in which the ambassadors of India, China and Tibet were present. It is the north-eastern boundary line of India, Which passes through the highest mountain region of the world. In some places it has been naturally determined by the rivers and in some places by the peaks of the Himalayas. The areas near the border being hilly and snowy are sparsely inhabited. India's border with China connects to 5 states. These include Laddakh, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. Laddakh's 1954 km, Arunachal Pradesh's 1080 km, Uttarakhand's 463 kms, Himachal Pradesh's 345 km and Sikkim's 220 km border connects with China. There are three major divisions of the Indo-China border, respectively, North Eastern, Central and North Western.

1. North-Eastern Sector - This part of the Indo-China border is 1140 kms in length from near the Talu Pass located in the eastern part of Bhutan to the meeting place of Indo-Tibet and Myanmar. The name of this boundary is Mc Mohan line. It is named after Henry McMahon, who was the British delegate to the Shimla Conference in 1913–14. Only this part of the Indo-China border is called McMahon Line, not the complete border. This boundary was accepted by the representatives of British, Chinese and Tibet at Shimla, although the Chinese representatives did not agree with it. According to this treaty, the international border was set at 3000-4000 meters high mountain peaks between the tributaries of Tsangpo flowing towards Tibet and Brahmaputra flowing towards India. Here one more thing is worth knowing that the Subanshree river originates from Tibet but its entire area was in the administered area of India and if the principle of water dividing line was fully accepted then all the villages like Migytun, Chapul and Yume etc. would be in the border of India. But the British rulers did not think of it as right to hurt the religious sentiments of the Tibetans and gave this part to the Tibetans by violating the water dividing line. This range is at the base of the northern watershed of the Brahmaputra River at the base of the crest of the Himalayas. Except at places where Lohit, Dihang, Subanshree and Nayamjung rivers cross this watershed. The area between the Mac Mohan line and the Brahmaputra plain is called 'North-East Frontier Agency' or NEFA, which is named after Arunachal Pradesh. It was a union territory. In this area, China expresses its authority over an area of about 94,700 sq km, which is a completely unauthorized attempt.

2. Central Sector -The India-China border in the central region is about 625 kms in length from Laddakh to the entire watershed. This border meets Uttarakhand and Himachal Pradesh of India. Here China expresses its own area of about 1300 square kilometers. China particularly asserts its authority over Barahoti, Nilang-Judhang, Lapthal, Shipkila Pass, Sang, Tsungsha Mala areas. For the first time, in the year 1954, China illegally attacked this area by claiming it as its own at a place called Barahoti. At the same time, a treaty was also signed between India and China, in which 6 passes of Himachal Pradesh and Uttarakhand were considered on one side and Tibet region on the other side. At present, the work of administration and tax collection etc. of all these areas is under the authority of India.

3. North-West Sector - In this part, the Indo-China border is spread over about 1770 kms. Or starts at the meeting point of India, Afghanistan and China and separates India's Ladakh from Sikkim and Tibet. The Indus River, originating from the north of Mount Kailash, passes through Laddakh. It is bordered by Kashmir in the west and Kangra district of Himachal Pradesh in the south. Baltistan is in the northwest of Laddakh. The area of Laddakh including Baltistan is 1,13,338 sq kms. China has occupied its area of about 38000 sq kms. On February 2022, the Minister of State for External Affairs gave this information in a written reply to a question in the Lok Sabha.China has been in occupation of Laddakh for nearly six decades. Apart from this, on March 2, 1963, Pakistan had given 5,180 sq kms area of its occupied Kashmir (POK) to China. If seen, in this way, China occupies a total of 43,180 sq kms of land of India.

Due to disputes, the border between the two countries could never be determined. However, to maintain the status quo, the term Line of Actual Control (LAC) began to be used, although it is still not clear. Both the countries line their different Line of Actual Control. Many glaciers, snow deserts, mountains and rivers fall on this Laine of Actual Control. Along with this, there are many such areas where there are often reports of tension between the soldiers of India and China.

C. India-Pakistan Border-The border between India and Pakistan is completely terrestrial and man-made, which starts from Laddakh and extends to Kashmir, Punjab, western Rajasthan and Kutch region.This line has been constructed by Sir Cyril Radcliffe after the partition of India in 1947, hence this line is known as Radcliffe Line. The length of this line is 3323 kms. The India-Pakistan border is considered very sensitive and dangerous. There is a Line of Control (LOC) between the two at Bagha in Kashmir and Punjab. Apart from this, there is a border area in Rajasthan and Gujarat, while the border of Pakistan's Sindh province is called Zero Point. India has had three wars and many military skirmishes with Pakistan. Explosives remain, especially along the Line of Control (LOC) and in the Siachen area.

D. India-Nepal Border -India and Nepal share a 1,751 kms long shared frontier, also known as the India-Nepal border or the Tribhuvan Division. This range starts from the state of Uttarakhand in the west and runs till the states of Uttar Pradesh, Bihar, West Bengal and Sikkim in the east. The length of the border is 263 kms in Uttarakhand, 560 kms in Uttar Pradesh, 729 kms in Bihar, 100 kms in West Bengal and 90 kms in Sikkim. The Indo-Nepal border is significant because of its religious, cultural and economic links, along with several natural and man-made demarcation features; Tourism, trade and human contact also take place here. An important feature of border is the presence of an ecologically divided market, known as the 'Bhairahwa market', between the city of Belhiya near Gorakhpur in the Indian state of Uttar Pradesh and the city of Bhairahawa in Nepal. This market is a major trading center for the people of both the countries.In addition, several religious sites associated with Kedarnath, Badrinath, Pashupatinath, Janakpur Dham, Lumbini, Manokamna Temple, EvatiGupteshwari and Raxaul are located along the Indo-Nepal border and are important sites for travelers.

E. India- Myanmar Border-The boundary line between India and Myanmar is called the Indo-Myanmar boundary line or the Indo-Myanmar boundary line. This boundary line is 1,643 kilometers long. The north-eastern ranges (which include Lushai, Naga, Patkoi and Arakanyoma) rising from the Himalayas form the land boundary between the two countries. It separates India from Myanmar by the Irawadi valley. The four north-eastern states of India Arunachal Pradesh (520 kms), Nagaland (215 kms), Manipur (398 kms) and Mizoram (510 kms) share borders with Myanmar. To promote commercial activities along the India-Myanmar border, there are several border check posts established between India and Myanmar. Trade, tourism, and other cultural and human contacts are facilitated through these check posts.

F. India-Bhutan Border-The total length of the border between India and Bhutan is about 699 kms. The four Indian states of Sikkim (32 kms), West Bengal (183 kms), Assam (267 kms) and Arunachal Pradesh (217 kms) share borders with Bhutan. The border between India and Bhutan is an important commercial and cultural barrier, with trade, tourism and cultural exchange between the people of the two countries. The Boundary Agreement between India and Bhutan was signed in the year 2007, which resolved the boundary disputes between the two countries as well as encouraged strong bilateral relations between the two countries.

G. India-Afganistan Border- The boundary line between India and Afghanistan is called the Durand Line. Its length is 80 kilometers. This line was determined by Sun Henry Mortimer Durand in the year 1896. Before the partition of India, the border between India and Afghanistan was determined by the Durand Line. It is the shortest border line of India and currently separates Pakistan Occupied Kashmir (POK) and Afghanistan.

2. Water Boundaries

The length of India's coastline is 6,100 kms, if the coastline of islands is also included in it, it becomes 7,517 kms. The mainland of India is washed on three sides by the Indian Ocean with its two seas namely the Arabian Sea in the west and the Bay of Bengal in the east. The Andaman-Nicobar Islands and the Lakshadweep Islands are located in the Bay of Bengal and the Arabian Sea respectively. India's neighbor across the ocean to the south is Sri Lanka, which is separated from India by the Palk Strait. The Palk Strait is named after the Governor of Madras, Robert Palk. Sri Lanka is situated just 96 kilometers away from Tamil Nadu. The boundary between Lakshadweep and Maldives is determined by the 8 degree channel. The 9 degree channel separates Kavaratti (Lakshadweep) from Milikaya (Lakshadweep). Whereas 10 degree channel separates Andaman from Nicobar, Coco Strait separates Coco Island (Myanmar) from Andaman (India), Great Channel separates Sumatra Island (Indonesia) from Indira Point (India), Deccan Strait separates Little Andaman from Nicobar. The Arabian Peninsula and the countries of Africa like Egypt, Sudan, Ethiopia, Somalia, Kenya and Tanzania are located across the West Sea from it. India's second closest neighbor after Sri Lanka is Indonesia, which is located at a distance of 106 kms from Indira Point.

1.4 SUMMARY

India, a vast and diverse country, is home to various religions, languages, cultures and tribes. It is filled with a rich history and heritage that blends modernity with the priceless legacy of its forefathers. India has many types of diversity in its external life, but in the end there is internal unity from Himalayas to Kanyakumari. In the words of great poet Rabindranath Tagore-

Hethayaarya, Hethay Anaaya, Hethay Dravid China

Shak, Hun, Dal, Pathan, Mogal, ek deh halo leen.

Means, Here there are Aryans, there are non-Aryans. There are Dravidians and Chinese people here. Shakas, Huns, Mughals, Pathans and don't know how many other castes people came here and united in the body of this country. India is a peaceful country. There is no such evidence in history that the Indian Army has ever invaded and occupied any foreign territory. Buddhist manuscripts in Chinese monasteries, Indian temples in Cambodia and Indian merchandise in Central Asia have been discovered by historians, but nowhere have they found evidence of a victory monument.

The ancient belief of India has been 'VasudhaivaKutumbakam'. Many important cultural and religious texts originated here. Important Puranic and religious texts like Vedas, Upanishads, Ramayana, Mahabharata and Gita have a significant place in Indian civilization.India's economy is the fifth largest economy in the world and it is a developing country. The Indian economy is mainly driven by agriculture, industry, services, financial services and information technology. India is a country filled with immense diversities and geographical beauty. The Himalayas, the Thar Desert, the Ganges River, the Taj Mahal, the Khajuraho Temples, the specialties of Goa, the idyllic beaches of Kerala, and other tourist destinations are the major tourist destinations of India. India is also a country of universities, institutes of technology, science institutes and other educational institutions. Many Indian and foreign students come here to study. India is famous for making significant contributions to the world in leadership, science, technology, health, sports, organization, solar energy, IT, pharmaceutical, food and agriculture.

Present India is a showcase of developing countries and nurturer of interests of third world countries. It has abundant natural and human resources available, using which judiciously can make it an ideal place among the countries of the world. India is a rising power of the world with immense potential.

1.5 GLOSSARY

Angiosperms - Flowering plants

Bhutan - Country in Himalaya's South Asia believing in Buddhism.

GMT (Greenwich Mean Time) - the mean solar time at Greenwich London's royal observatory at 0° longitude.

Gymnosperms - vascular plant having naked Seed or ovule.

Heterogeneity - Diverse in character or content.

Java - One of the great Sunda Island in Indonesia.

Latitude – The angular measurement of a point on surface in North or South from the Equator.

Longitude – It is an angular measurement of point on the surface in east to west from the prime Meridian.

Meridian – Imaginary lines that sum around Earth vertically connecting points of equal longitudes and meet at the North and South poles.

Minicoy Island - commonly known as Maliku, is an island of Lakshadweep.

Mysticism - belief to reach complete truth and knowledge of God.

Parallels of latitude- Imaginary horizontal lines sum East and West, parallel to the Equator, connecting points of equal latitudes.

Polytheism - belief in more than one God.

Province - the part of country which has its own local government.

Sub- continent - part of a large continent, made up of a number of countries.

Suez Canal - an artificial waterway connecting the Mediterranean sea to the Red sea dividing Africa and Asia.

Tropic of Cancer - the tropic of Cancer is a parallel of latitude at an angle of 23.5 degree north from the equator.

1.6 ANSWER TO CHECK YOUR PROGRESS

1.India Has been known by many names since ancient times like, Bharat, Jambudweep, Aryawart, Brahmawart, Hindustan, India etc.

2. Seventh largest in area and second largest in population.

3. Areal extent is 32.87 Lakh sq. kms., 2.4% of the total surface area &0.57% of the area of the globe.

4. Latitudinal extent is 8º4′ N to 37º18′ North.

5. Longitudinal extent is 68º7′ E to 97º25′ East.

6. Standard Meridian is 82º30′ East, passes from Mirzapur Near Prayagraj.

8. India is south part of Asia continent.

9. India is washed by Indian Ocean on its south.

10. India has diversities in physical, human and cultural features.

11. The north-south extent is 3214 kms.

12.The east-west extent is 2933 kms.

13. The Tropic of Cancer passes through 8 states of India - Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram.

14. The position of the Northern Himalayas protect it from the cold winds coming from Siberia in winter.

15. The empires of Chola, Pandya, Pallava etc. in South India established their colonies in eastern countries.

16. About 16.2% of the world's population resides in India.

17. The northernmost point of India is Indira Col (Jammu & Kashmir), while the southernmost point is Cape Comorin (Kanyakumari, Tamilnadu), the southernmost point away from the mainland is Indira Point (Andman and Nicobar Islands).

18. The eastern Point of India is Kibithu (Arunachal Pradesh), while the western point is Gohar (Gaur) Moti (Sircreek, Gujrat).

19. Malacca Strait has brought Singapore and other islands closer to India.

20. Suez Canal opening has brought South European countries closer to India.

21. Bali, Java, Sumatra are typical names originated from India.

22. France, Portugal, Britain, Holland developed their colonies in India.

23. East India Company was established by British.

24. The eastern region is connected to the rest of the country by only a 24 km wide land corridor between Bangladesh

25. India is the birth place of Buddha, Jain and Hindu religions.

26. India's relations through land frontiers are much older than water frontiers.

27. India is an integral part of the oriental world.

28. India's land frontier is 15200 kms. long.

29. India shares 3917 kms. long border with China.

30. Five Indian states Laddakh, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh touch Indian boundary with China.

31. India has the longest international boundary with Bangladesh.

32. India has always referred Mc Mohan Line as an international line between Tibet and India.

33. India's border with Nepal follows foothills of the Siwalik Range.

34. India – Bhutan boundary is 587 kms. long.

35. India touches Nepal by Uttarakhand, Uttar Pradesh, Bihar, Sikkim and West Bengal.

36. Bhutan has West Bengal and Assam on its Indian border.

37. India's border with Bangladesh is touched by west Bengal, Meghalaya, Assam, Tripura, and Mizoram states.

38. India's boundary with Bangladesh is purely flat and man-made.

39. Bangladesh border has the pressure of the influx of refugees.

40. Nagaland, Arunachal Pradesh, Manipur and Mizoram states are situated along Mynamar border.

41. The boundary between India and Pakistan is known as Redcliffe line.

42. India's Coastal line in all is 7517 kms. long.

43. Palk Strait separates India with Sri Lanka.

44. India officially is known as Republic of India.

45. India has 28 states and 8 union territories.

46. Telangana is the newest state of India, carved out in 2014.

47. On 31 October, 2019, The Jammu and Kashmir Reorganization Act of 2019 transformed Jammu and Kashmir into the new Union Territory of Jammu & Kashmir and the new Union Territory of Ladakh.

48. On the occasion of 71st Republic Day (26.01.2020), Union Territories of Dadra-Nagar Haveli and Daman-Diu came into existence.

49. Rajasthan is the largest state in area.

50. Uttar Pradesh is the largest state in population.

51. The density of population in India is 382 persons per sq. km. in 2011.

52. India's population in 2011 is 1216 million.

53. Bihar is the most densely populated state with 1106 persons per sq. km.

54. The number of females per 1000 males is 943 females in 2011.

55. India has recorded 7933 towns and 640930 villages in 2011.

56. The growth rate of population is 17.7 percent during 2001-2011 decade.

57. The percentage of effective literacy is 73.0 percent.

58. Great Plains is the unifying force between the plateau and mountain regions.

59. India is a multi-lingual nation.

60. India is committed to make a strong, powerful and prosperous nation.

61. The ancient belief of India has been '**VasudhaivaKutumbakam'**.

1.7 REFERENCES

Census of India, 2011.

Mamoriya, C. (2000), Advance Geography of Modern India, Sahitya Bhawan Publishers and Distributers Li., Agra.

Maurya, S.D. and Shalini (2014), Cultural Geograophy, Sharada Pustak Bhawan Publishers & Distributers, Prayagraj.

Nag, Prithvish and Sengupta, Smita (2002), Geography of India, concept Publishing Company, New Delhi.

Saxena, H.M. (2017), Political Geogeraphy, Rastogi Publication, Meerut.

Singh, Upinder (2018), History of Ancient and Early Medieval India, Pearson India Education Services Pra. Li., Noida.

Spate, O.H.K. and Learmonth, A.T.A. (1967) India and Pakistan: A General and Regional Geography, Methuen, London.

Tiwari, R.C. (2016), Geography of India, Prawalika Publications, Prayagraj.

1.8 TERMINAL QUESTIONS

(A)Long Questions

1. Explain the geographical importance of India both in present and past.

2. India is known as the country of "unity in diversity". Elaborate.

3. Give a detailed account of India's international boundaries.

4. Elucidate the location and size of India in globe.

5. In different ages India is known by different names. Give an elaborative account.

(B) Short Questions

1. Explain the latitudinal and longitudinal location of India.

2. Explain the different names of India according to different religions.

3. Explain the difference in the living condition of the different parts of India because of its longitudinal expansion.

4. Give a brief account on ancient India.

5. Elaborate the Geographical diversity of India.

6. Write short notes on:

a. Cultural diversity of India

b. Religious diversity of India

c. Linguistic diversity of India

d. Ethnic diversity of India.

9. Give a brief accounts how India's Central location is beneficial for its neighbouring countries.

10. Explain water frontiers of India.

11. Explain land frontiers of India.

11. Explain site and situation of India.

12. Explain Indo - China Border.

13. Short note on India – Bangladesh Border.

14. If the exact time at Greenwich (London) is 10.00 AM, then what will be the time in India at that exact time?

(C) Multiple Choice Questions

1. The Standard Meridian of India is:

(a) 82º30´ East (b) 88º10´ East

(c) 85º30´ East (d) 80º30´ East

2. Which of the following union territories of India has the highest density of population per sq km?

(a) Laddakh(b) NCT of Delhi

(c) Jammu & Kashmir (d) Chandigarh

3. The India's highest annual rainfall is reported at

(a) Namchi, Sikkim(b) Churu, Rajsthan

(c) Nainital, Uttarakhand (d) Mawsynram, Meghalaya

4. How many Union Territory are in India:

(a) 07 (b) 09

(c) 08 (d) 06

5. Which Indian state share the longest land border with Bhutan?

(a) Assam (b) Arunachal Pradesh

(c) West Bengal (d) Sikkim

6. Which Indian state has the highest populationDensity?

(a) Andhra Pradesh (b) Maharashtra

(c) Uttar Pradesh (d) Bihar

Answer– 1 (a), 2 (b), 3 (d), 4 (c), 5(a), 6(d).

UNIT 2 - GEOLOGY AND PHYSIOGRAPHIC REGION

OBJECTIVES

After having the detailed study of this unit, you will be able to:

- To discuss important inter-related physical attributes of India's land surface.
- To study geological, structure, rock types and their economic importance.

2.2 INTRODUCTION

Geological structure is a controlling factor in the determination of relief and physiographic features, and also in the formation of rocks and minerals. Such study is quite fundamental to various economic activities including mining and agriculture. Sedimentary rocks have helped in the formation of alluvial soils, which are excellent in agricultural production. These rocks are also known for fossiliferous marine deposits containing petroleum and are found near Ankleshwar and Khambhat area. Igneous and metamorphic rocks produce soils of low fertility, but these are rich in the deposits of metallic and other useful minerals. The old Archaean Rocks are to be proved rich for the reserves of gold and iron ore. Rocks of Carboniferous epoch are known for coal reserves. Iron ore and coal are the foundation of industrial development. Petrol is main base of transport industry, whereas agriculture depends on soil quality. Thus, the knowledge of geological structure and relief of the country is essential to study all of these above facts. This is quite fundamental to its economic development.

The present relief in the country is a consequence of the upheavals in its geological history. The rock structure is the creation of the process. After these internal processes, the exogenetic processes worked upon them. Running water is the chief among these. It has also given its important effect on the natural drainage.

2.3 GEOLOGY

The geological history of India is just similar to human history. It is both complex and varied. It has gone through the various stages of geological formations ranging from the Pre-Cambrian to the recent times. These Pre-Cambrian Rocks are as old as India itself, while recent rocks of quaternary Period are found in the form of sedimentary deposits of alluvial soils.

The Peninsular massif is made up by old to oldest rocks. It is the part of Gondwanaland. The Himalayan Mountain and related new folded mountain ranges have new rocks, younger than Peninsular India. These are the formation of sea sediments. These mountains have given the birth to Great Plains of India, which is the result of the deposits brought by the rivers of Himalayas. Thus, it clearly depicts that all the three physiographic regions have emerged out one after one and thus all of these have most striking geological contrasts.

Geologically, India represents a monumental assemblage of rocks of different character belonging to Pre-Cambrian to the recent times. These rocks of India have four important groups, which are as follows:

1. Pre-Cambrian (Archaean) group of Rocks
2. Purana group of Rocks
3. Dravidian group of Rocks
4. Aryan group of Rocks

1. Pre-Cambrian or Archaean Group of Rocks–

In 1915, W.C.F. Smith and R. Bruce Foote had firstly studied these rocks. The word Archaean was used by J.D. Dana for rock structure prior to the Cambrian system. These are classified into two systems:

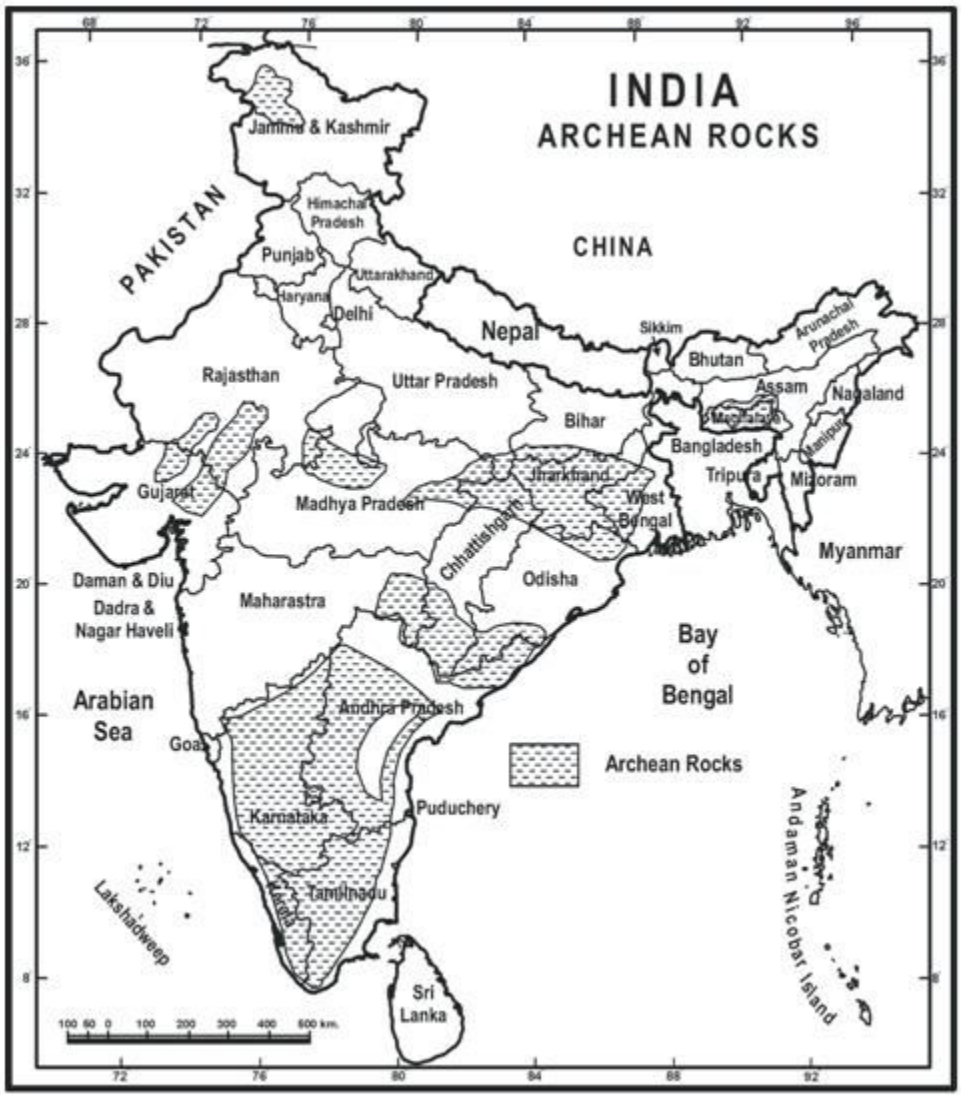
(a) Rocks of Archaean System– These are the oldest rocks in the world even than man himself. These were the first to be formed at the time of cooling and solidification of the upper crust of the earth' surface in the Pre-Cambrian era about 4000 million years ago. These are highly metamorphosed rocks, and have lost their original form. These are crystalline and have the absence of fossils. These have been under the influence of internal forces. These are of gneiss, granite and schist type.

These are extended on 187,500 sq.km area. They occupy the Karnataka, Tamilnadu, Andhra Pradesh, Telangana, Madhya Pradesh, Chhattisgarh, Odessa, Jharkhand, western Part of West Bengal and south Rajasthan. In the extra-peninsula, these rocks are exposed in the core areas of main Himalayas.

(b)The Dharwar System– These rocks have derived its name from the rocks first studied in the Dharwar district of Karnataka. These are found in abundance here, and occupy just half of the state. These have derived their materials from Archaean system and are highly metamorphosed. These have the absence of fossils. These are the most ancient metamorphosed sedimentary rock system of India. These are very old one. The weathering of the Archaean gneisses and schists yielded the earliest sediments which were deposited on the bed of the sea, and formed the oldest sedimentary strata known a Dharwar system. At few places, these are highly metamorphosed, and are not easily distinguished from their primitive formations. These are not found in horizontal layers or in their original form.

These are extended in most part of Karnataka, Rajasthan and some parts of Gujarat, Jharkhand, Chhattisgarh, Odessa states of peninsular India. In the extra-Peninsular region, these are extended in lower valleys of western Himalayas, in east Meghalaya and Arunachal Pradesh.

Fig. No. 2.1 Distribution of Archean Rocks in India



The Dharwars are most important rocks of economic value. They possess valuable minerals like high grade iron ore, manganese, mica, cobalt, asbestos, garnet, marble, lead, quartzite, gold and copper. Kolar and Dharwar Valleys are known for gold, while iron ore is found in Jharkhand, Odisha, Goa, Madhya Pradesh, Chhattisgarh and Karnataka.

Aravalli Hills, the oldest folded mountains were formed in Dharwar Period. These hills possess the most diverse lithological characters, being a complex of all kinds of rocks-plastic sediments, and chemically precipitated rocks, volcanic and plutonic rocks all of which generally show an intense degree of metamorphism.

2.Rocks of Purana Group

These rocks were formed after a long gap of the formations of Dharwar Rocks. This term Purana is also known as Proterozoic. The geological movements in this period gave the formation to Kuddapah and Vindhyan system rocks.

(a) Rocks of Cuddapah System– These rocks have been formed in Eparchean Period after a long interval of time elapsed after the formation of Dharwar system. These are named after Kuddapah, a District of Andhra Pradesh, where these rocks are found in irregular crescent shape on an extensive area. Naturally, Kuddapah system is separated from the Dharwar system by a great unconformity. These rocks have a 6000 mts. thickness in southern India. The outcrops of cuddapah rocks suggest that these were subjected to compressive forces directed from the concave side near which stood high mountains which supplied materials forming the rocks of the basin. In due course of time, these deposits took the form of sedimentary rocks, which are known as Cuddapah system of rocks. Shale, quartzite, slate and limestone rocks were the parent rocks, which were highly metamorphosed. This metamorphism was comparatively low than the Dharwar Rocks. These have not evidence of fossils, inspite of the proof of existence of life on the earth.

These rocks cover an area of 22000 sq. kms. and are found in Andhra Pradesh, Chhatisgarh, Rajasthan, Maharastra, Tamilnadu and in some areas of Himalayas. Krishna River valley, Nallamalai Hills, Cheyar River valley and Papaghani River valley have the extension of these rocks in peninsular India. These are also found in scattered form in Belgam of Karnataka and mid-valley of Godavari. In Rajasthan, these are extended in its south-east part and also near Delhi Hills. In Extra-Peninsular Region the rocks are extended in Kashmir and Himachal Pradesh.

These rocks are less significant economically than Dharwar Rocks. These are having the minerals in less quantity. These rocks contain mainly iron ore and Manganese. Asbestos and talc are obtained from Cuddapah and Karnool districts. Marble stone and colourful stones are also found. These also contain large deposits of building purpose. Quartzites and cement grade limestones, Copper, Cobalt, nickel are obtained in East Rajasthan.

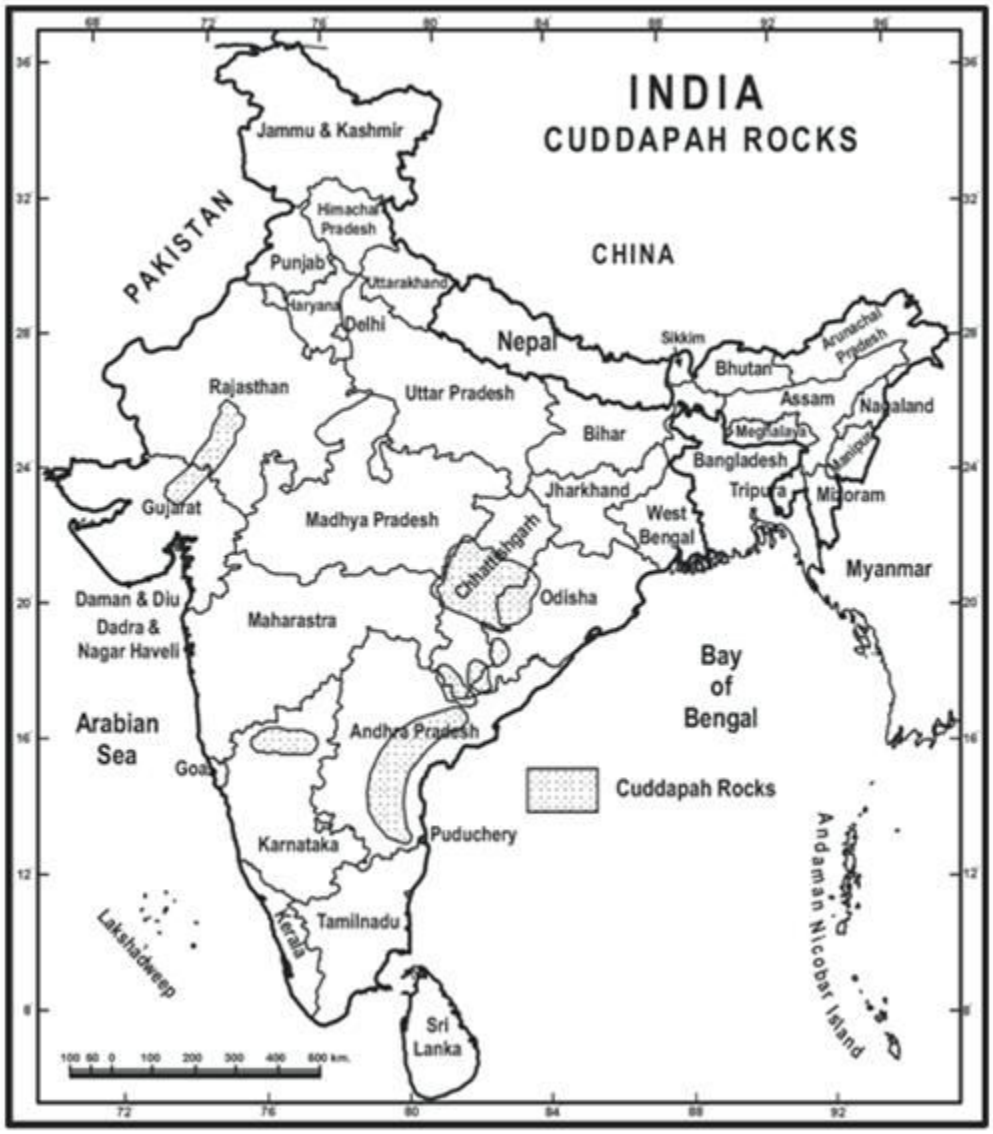
(b) Rocks of Vindhyan System–

This system derives its name from the great Vindhyan Mountains. The rocks are studied by a number of scholars. Among them E. Braden Burg, R.D. Oldham, Medlicott, F.R. Mellot, W.King, A.M. Heron and J.B. Odem are most important. O.H.K. spate has tried to distinguish between the Vindhyan rocks and the Vindhyan hills.

These rocks are made after Cuddapah Rocks. These are ancient sedimentary rocks, superimposed on the Archean base. Sandstones of Vindhyan Rocks are the evidence of those deposits which took place in shallow seas, and river valleys.

The rocks of the vindhyan system comprise two distinct but unequal sets of deposits:-

Fig. 2.2: Distribution of Cuddapah rocks in India.



(a) The Lower Vindhyan Rocks– These are 1300-1100 million years old and are marine in origin, mostly calcareous in nature and shows tectonic deformation by folding movements. These rocks possess quartzite in lower parts, shale in the mid and lime stone in the upper part of rocks. Their distribution is as follows:

(i) In son valley, these are known as Semri Series.

(ii) Kurnool series in south west part of Andhra Pradesh.

(iii) Bhima series of Bhima River valley in Karnataka.

(iv) Palni series of Chittorgarh and Jodhpur in Rajasthan.

(v) Upper Godavari valley, Malwa region in the north of Narmada Valley and Bundelkhand region have few specialized areas of these rocks.

The Upper Vindhyan Rocks– These are 1000-600 million years old, and are fluviatile in origin. These are found in undisturbed horizontal strata. Sandstone, shale and conglomerate are the main rocks. In Aravalli Region, these rocks are found on the upper surface of Dharwar system of rocks. These are widely distributed in the following peninsular and extra-peninsular areas.

(i) Mander, Rewa and Kaimur Series in the north of River Narmada.

(ii) Central Railway rail route between Katni to Allahabad.

(iii) Areas lying near Dehri-on-son of Jharkhand.

(iv) Aravalli Hills and nearby areas.

(v) Nearby areas of Pir Panjal and Dholadhar Ranges, spiti valley and Shimla. These are known for slate stone.

Economic Importance: These have large quantities of excellent and durable limestone, sandstone, Chinese clay, flagstones, fire clay, pure glass making sand. Limestone is the base of cement industry. Sandstone is of red colour and is being used in the construction of buildings. Red fort and Jama Masjid of Delhi, Stup of Sanchi, Fatehpur Sikri, Red fort, and Sikandara of Agra are made up by these stones. These are also known for Panna and Golcunda Diamonds.

3. The Dravidian Rock System

The rocks of the Dravidian system came into existence between 600-300 million years ago. These are mainly found in extra-Peninsular Region. Peninsular Region does not have the presence of such rocks. The Dravidian Era is marked with the beginning of life on the earth, and because of that, this rock system contains abundant fossils. The rocks of Cambrian, Ordovician, Silurian, Devonian and carboniferous periods are the rocks of Dravidian System.

(a) Cambrian Rocks– This name is derived after Cambria the latin name for Wales in Great Britain. These occur in Baramula, Anantnag districts and Pir Panjal areas of Kashmir and Spiti valley of Himachal Pradesh. They consist of the deposits of states, quartzites, sandstones, clay, salt and dolomites. It has Salt Range on India-Pak Border.

(b) Ordovician Rocks– This name is after the ordovices, former inhabitants of wales. These are mainly found in the Lidar valley in Kashmir spiti valley of Himachal Pradesh and Kumaon Region of Uttarakhand. Quartzites, sandstones and limestones are the main deposits.

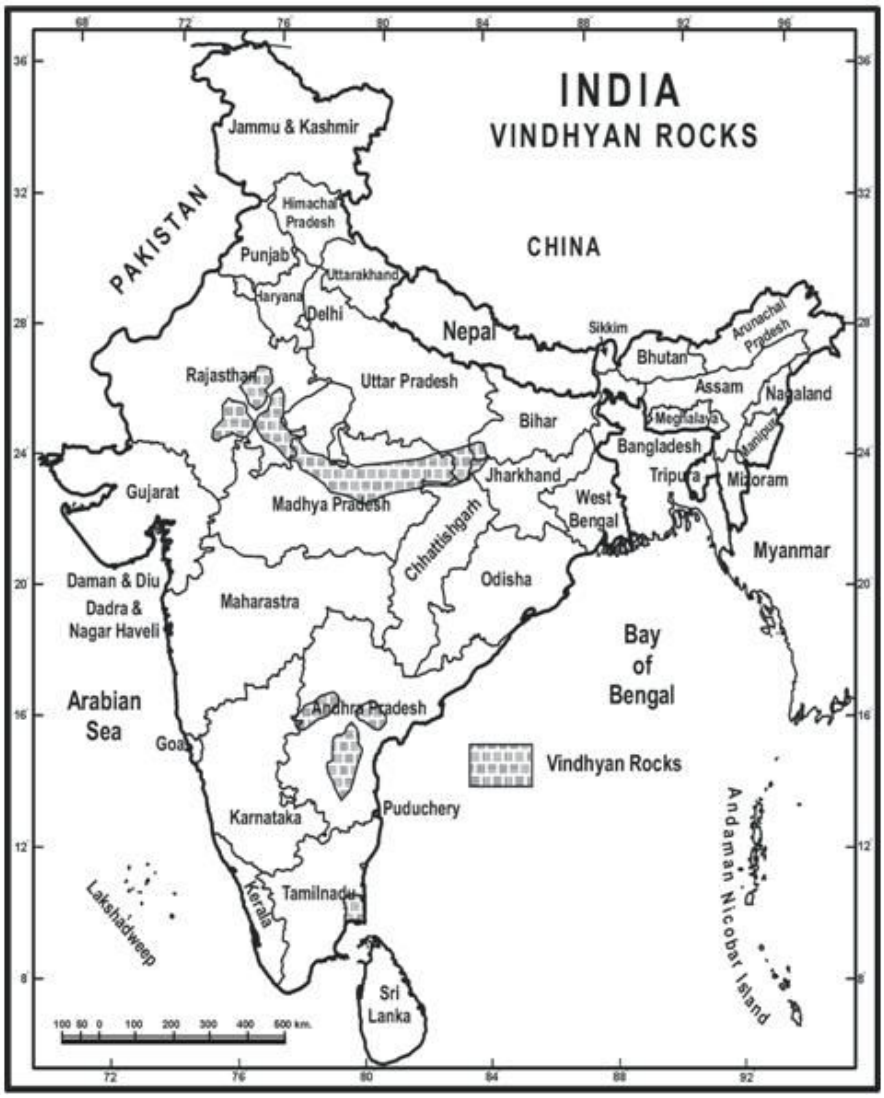
(c)The Silurian Rocks– This name is also after the Silures, former inhabitants of wales. Spiti and Kullu valleys of Himachal Pradesh, Handwara and Lidar valley in Anantnag of Kashmir have the extension of these rocks. Limestone and Shales are the main deposits.

(d)The Devonian Rocks– This name is also after Devonshire of England. These rocks are quite thick with quartzite reaching thickness 900m. at certain places. They are devoid of any fossile remains. Such deposits do exist in Lidar valley, Pir Panjal area, Spiti valley.

(e)The Carboniferous Rocks– These are 350 million years old, and are divided into Upper, Middle and Lower Carboniferous System, which are also included in the Rocks of Aryan Group. Coal formation got start in Carboniferous, which in geology means coal bearing. These were known afterwards by the name of Gondwana system.

Upper Carboniferous Rocks are made of limestone and dolomite. Mount Everest is composed of these rocks. Middle carboniferous is the age of Himalayan upheavals. Lower Carboniferous has slates of different type. Western and eastern Himalayas do have these deposits.

Fig. 2.2: Distribution of Vindhyan rocks in India.



4. The Rocks of Aryan Group

The Aryan group comprises the rock formations ranging from the upper Carboniferous to Recent Period. These are fairly preserved in the Peninsular India and are found in perfect sequence in extra-Peninsular Region. During this period, the map of India has noted heavy changes.

Himalayan mountains and Great Plains were formed during these periods. It is not wrong to say that Indian sub-continent assumed its present shape. The rocks of Aryan Group belong to the systems of Gondwana, Deccan Traps, Tertiary and Quaternary.

(I) Rocks of Gondwana System

The use of term Gondwana was made by H.B. Medlicott in 1872. After him O. Feast Mantle had used this term in 1876. This system has derived its name from the Kingdom of Gond region of Madhya Pradesh, from where the presence of these rocks was noted for the first time. Afterwards, this name was frequently used for those lands, where such rock deposits were found.

Origin of Rocks– According to Geologists, the formations of these rocks had taken place during the Jurassic period and Upper Carboniferous period. It is assumed that earth movements couldn't take place for a long time after the formation of the rocks of vindhyan system. Hercynian Movement in Upper Carboniferous period left its effect on the entire globe. The distribution of water and land was changed in most parts of the earth. A sea known as Tethys was developed from west Mediterranean Sea to China. In the north of this sea, was Angaraland and in the south, India, Africa, South America, Australia and Antarctica were developed in the form of Gondwanaland. By this time Kara-Koram, Kunlun and a number of central Asian Mountain ranges were emerged out on the south flanks of Angaraland.

This system has experienced several climatic changes during the process of deposition of sediments. The Ice age, made active to glaciers which accelerated the rate of erosion in high mountain areas. This eroded material began to accumulate in the river valleys and shallow water areas. River valleys were become fertile. These lower areas were having hot and wet climate which gave the luxurious growth to terrestrial plants. These terrestrial plants were named as Glossopteris flora. These plants were subsided in the shallow water areas and this change in the form of vegetation is now known as coal deposits. These rocks are still found in the form of horizontal layers, and are free from all disturbances. The remnants of fishes and creep animals are also found in these rocks. Their deposition in the river valleys gave protection to their original status. Their formation took a long time from Upper Carboniferous to the Jurassic period, which noted a number of climatic changes.

Distribution of Gondwana Rocks– These rocks are observed in narrow valleys of South India. Its triangular shape has noted their presence on the flank of its both sides. On the

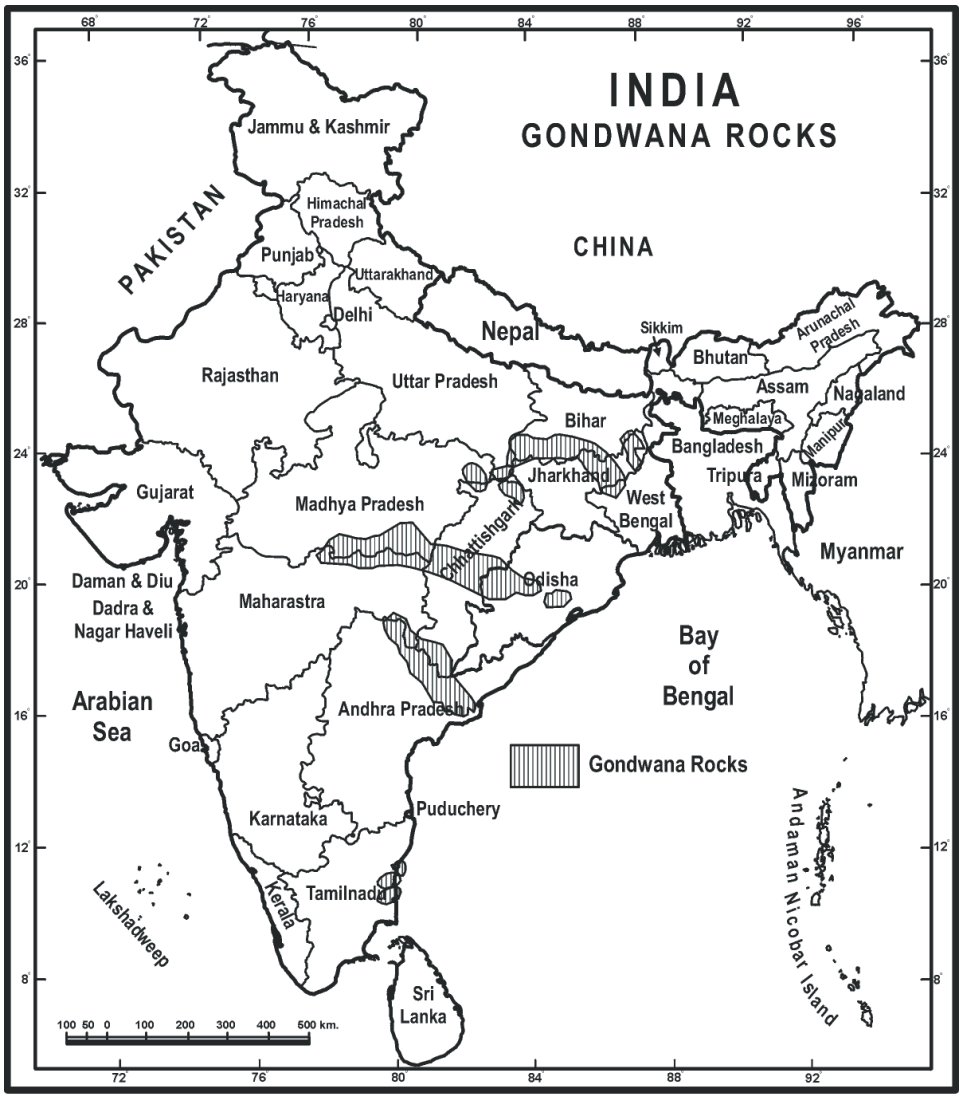
eastern coast, these are found in the upper layers. These are found in peninsular and extra-peninsular areas.

(a) Rocks of Peninsular Areas- (i) In Damodar Valley extended upto Rajmahal Hills, (ii) In Mahanadi Valley, (iii) In Godavari valley and in its tributaries-Venganga, and Wardha Valleys, (iv) In Kutch, Kathiawar, west Rajasthan, north-east Andhra Pradesh and east Tamilnadu.

Thus, these rocks are distributed mainly in Jharkhand, Madhya Pradesh, Chhatisgarh, Andhra Pradesh and Odisha.

(b) Rocks of Extra-Peninsular Areas- Here, their identification is quite typical, due to their high metamorphism, and thus are quite different from Gondwana rocks of peninsular India. Their presence can be marked in Kashmir, Sikkim, North West Bengal and Assam.

Fig. 2.2: Distribution of Gondwana rocks in India.



Economic Importance- These rocks contain above 98 percent of our coal reserves. Sandstones, slates and conglomerates are used as building materials. Chinese clay is used in brick and ceramic making. These have their importance for cement, chemical fertilizer industries.

(II) Deccan Traps

It covers over an area of 5 lakh sq. kms. of peninsular India. The period of their formation is from the end of cretaceous period till the beginning of Eocene period. During the last Mesozoic period, a vast area was flooded by the outpourings of extremely mobile basalt lava from fissures and cracks. It covered fully the pre-existing topography. These volcanic deposits have flat top, and thus executed a shape of plateau, known as Deccan Plateau. It has horizontal lava layers, with steep sides. Because of these sides it is called trap, the name derived from the Swedish word meaning a stair or step. Spate has preferred to use the term 'Deccan Lava'. It has great variation in thickness of lava layers. It varies from 1-2 to 35 mts. The thickness is declined towards the east, but it reaches to 2134mts in the west side.

Deccan trap mainly has the nature of Basalt and Dolerite. These rocks are very hard. The weathering of these rocks for a long time has given birth to black cotton soil known as regur. This trap has also given birth to laterite soil, which is the creation of Monsoon climate. It has the contents of Aluminium, iron and manganese. The colour is dark brown, brown and purple. The relative density of Basalt and dolorite is 2.9. It has uniformity in chemical composition. The content of silica is 50 percent. The other chemicals are iron, calcium and magnesium. The Deccan trap has been divided into three groups:-

(i)Upper Traps- It is extended mainly in Maharastra. It has numerous inter-trappean beds and layers of volcanic ash. The average thickness is 460 meters.

(ii) Middle Traps- These are 1200 mts thick and are spread mainly in Madhya Pradesh. It has numerous ash beds in the upper portion and is practically devoid of inter-trappeans.

(iii)Lower Traps- These are found in east side. It is only 152 mts thick. It has inter-trappean beds with rare ash beds.

Economic Importance of Deccan Traps– These rocks are a great source of building stones and road building material. These have quartz, agate, calcite and Pyrite, mainly near Rajpipla, Khambhat and Ratnagiri. Bauxite deposits are found in Maharashtra, Madhya Pradesh, and Jharkhand. It is used as ore aluminum, also in petroleum refining.

(III) Rocks of Tertiary System

These rocks were formed from Eocene to Pliocene period about 60 to 7 million years ago. This period is known as tertiary Era. It is the most significant period in India's geological history, because the Himalayas were born and India's present form came into being in this period. It gave us two physiographic regions-Himalayan Mountains and Coastal lands of

peninsular plateau. The Tertiary has been called as the Age of the Mammals because of the abundance of the fossil remains of these animals in the deposits of this period.

Origin of Himalayas– Tethys Sea, during this period noted revolutionary changes. It was extended between Gondwanaland and Angaraland. This sea was a long, narrow and shallow. It was filled up with sediments, brought by rives from both these landmasses. These sediments were subjected to powerful compression. This compression, due to the movement of both the land masses towards each other attributed the orogenic movements on the basis of Tethys Sea. These movements gave birth to Himalayas, Iranian, Cacasus, Carpathian, Alps, pyrenese mountains. The upheaval of Himalayas is a sum of four or five stages. These stages belong to upper cretaceous, upper Eocene, middle Miocene, Pliocene, and lastly to Pleistocene.

Primary tertiary rocks are sea rocks, which have deposits of shallow and deep water. In the north-west Eocene rocks are marine rocks, Whereas Murrie rocks are the rocks formed on the confluence of sea and river. Siwalik rocks are fluviatile rocks.

Distribution– These are found mainly in extra-peninsular region. In peninsular India, their distribution is limited up-to coastal areas. The Tertiary system is generally divided into the following three systems of rocks:-

(a)Eocene System Rocks– It comprises three series- (a) Marine facies- These are found in Jammu and Kashmir, and north part of Himalayas. These rocks are made by the lime. (b) Coastal facies- These are found in Jammu, near Shimla and Garhwal Himalayas. These have shrinked towards the east. (c) Fresh water facies- Such rocks are found in eastern states and Myanmar.

In north-eastern parts of the country, the Eocene is represented by limestones and coal bearing sandstones in Meghalaya. The Barail series has a wide distribution in Surma valley and Naga Hills. It has also tertiary coal deposits. The middle parts of these rocks do contain the reserves of petrol. In Rajasthan, Palna deposits of Bikaner district are known for Tertiary coal. Surat, Broach and Kutch districts have deposits of the Eocene system.

(b) Oligocene and Lower Miocene System Rocks– These are 40 to 25 millions year old. It was a period of inter-mountain formations process. The tertiary outcrops suffered considerable denudation which resulted in the removal of rocks belonging to this system. These rocks are found in Jammu & Kashmir, Assam and other eastern states of India.

(c) Mio-Pliocene System– It is fully developed in India. It gave the birth to third upheaval of Himalayas and by this time, the sediments of Mio-Pliocene rose up and gave the birth to Siwaliks. These are found all along the foothills of the Himalayas. These contain sandstones, grits, conglomerates, clays and silts, which give an evidence of their deposition in lagoons and fresh water lakes made by rivers at that time. At some places Shiwaliks are highly fossiliferous. It has a variety of fossils showing wide range of environment from humid forest conditions to aridity.

In Andhra Pradesh Cuddalore and Rajahmundry rocks are of such type. These are sandstone rocks. Such rocks are also found in the area lying between Rameshwaram and Puduchery in an elongated and wide belt, and also in Nellore and Godavari districts of Andhra Pradesh. These have mammalian fossils. The sea coast near Kollam in Kerala state has also deposits of limestone rocks. These rocks are famous for clays of different varieties and sandstone is used in the construction of buildings.

(IV) Rocks of Quaternary System

It is a brief period of nearly one million years and is said to have just begun. It has two divisions without a clear-cut boundary between them. The older is Pleistocene and the younger is called Recent.

(1) Pleistocene Rocks– It is marked by cold climate and glaciation. De Terra and Patterson has divided this period into four glacial and three inter-glacial periods. At this time sea level was lowered by about 100 meters than it is now. Himalayan glaciers were also much larger during the glacier period. The evidences of such incidents can be marked by moraines, boulder fans and thick fluvo-glacial materials. These moraines left their impact on the drainage system, which resulted at some places in the form of lakes.

The Karewas of Kashmir are such rocks, which were deposited in Karewa Sarovar during second glacial and inter-glacial periods. The flat topped terraces of Kashmir valley, and on the flanks of the Pir Panjal consisting of clays, sands, silt together with conglomerates are known as Karewas in Kashmiri Language. Karewa Rocks are spread over an area of 7500 sq. kms. These are 1600 mts thick and are in the form of horizontal layers. These rocks were uplifted in the form of Pir Panjal on the south flank of Kashmir valley. This valley is an evidence of the emergence of the surface of Karewa Sarovar.

Karewa Rocks are riverine. These have the remnants of Chir, Oak, Beach, Cinnamon, which proves, that the climate was temperate at that time. Fresh water mammals, fishes, remains are also found in these rocks.

Older Alluvium– The alluvial deposits of Sutlej valley, Narmada and Tapi valley, and in the upper valleys of Godavari and Krishna rivers are also of the Pleistocene Period. Here fossiferous clays, sands and gravels are also of this period.

Indo-Gangetic Alluvium–These are the most important deposits, brought by Indus, Sutlej, Ganga and Brahmaputra Rivers. They were able to fill up the great depression lying between the foot of the Himalayas and the northern edge of the Peninsula. These deposits have a great variation in depth. This depth is assumed nearly 1800 to 2100 mts. In upper Assam these alluvial deposits have high depth. These deposits are made by sand and clay. These are of two types:

(i) Older Alluvium– It is called Bhangar. The colour is dark and has also composition of nodules. It is of Middle or upper Pleistocene age.

(ii) New Alluvium– It is called Khadar. The colour is light and contains nodules and sand. It is good reservoir of underground water. It is of upper Pleistocene age.

The coastal areas of Peninsular India have also alluvial deposits of Pleistocene age. The coasts of Odisha, Andhra Pradesh, Tamilnadu and Gujarat have these deposits in a broader area. It is marked by deltas of Great River like of Mahanadi, Godavari, Krishna and Cauvery. There are several lagoons. Chilka Lake and Pulicut lakes are outstanding lagoons. Rann of Kutch has an evidence of both submergence and emergence. It was a part of sea in Pleistocene age, but now it is filled up with the deposits of Pleistocene and recent age. The Thar Desert of western Rajasthan has also an evidence of deposits of these ages.

(2) Recent Rocks– These are still today in the process of formation. This age is responsible for the formation of mouth of rivers, and coastal sand dunes. Narmada, Tapi, Mahandi, Godavari, Krishna, Cauvery, Periyar Rivers have deposited alluvium in large quantity on their mouth.

In brief, it can be ascertained that Peninsular India has the Rocks of oldest period to recent period. Here are such old rocks, which have changed their original form. On the contrary, Himalayan and Great Plain Regions both are decorated by the rocks of Tertiary and Recent age.

2.4 PHYSIOGRAPHIC DIVISIONS OF INDIA

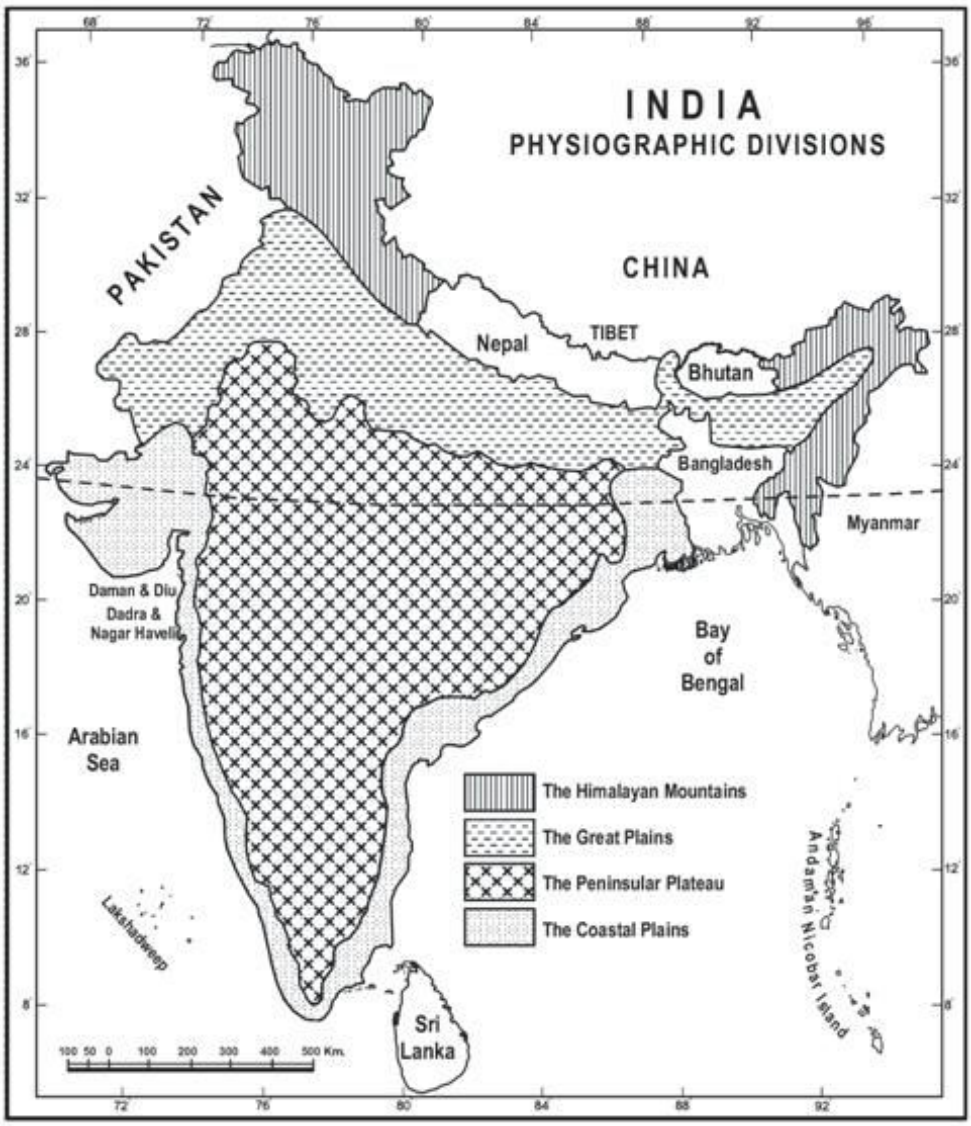
The surface of the country is as complex as its making. It has great physiographic diversity on account of the differences in geological structure, history and involved denudational processes. It has all type of landscape such as mountains, hills, plateaus and plains. Nearly 11 percent of total area is mountainous, 18 percent hilly, 28 percent plateau type and remaining 43 percent is having plain surface. It has more extension of plain surface than the world's average.

Determination of Physiographic Regions

Due to geological complexities and geomorphological diversities, division of India into physiographic regions is a difficult task. Some geographers have divided into three physiographic divisions, and some scholars have determined coastal plains as a separate region. The question is not of three or four physiographic regions, but it is very ascertain that all these regions are quite different from each other due to physiographic and geological point of view. Thus, to be more realistic, it is preferred to divide India into following five physiographic divisions:

1. The Himalayan Mountains, 2. The Great Plains, 3. The Peninsular Plateau, 4. The Indian Coasts and 5. Islands.

Fig. 2.5: India: physiographic divisions.



2.4.1 HIMALAYAN MOUNTAINS

High relief, snow capped summits, deeply dissected topography, antecedent drainage, complex geological structure and rich temperate flora in sub-tropical latitudes give a very distinctive character to the well-defined mountains of India– the Himalayas. It is extended in between the gorges of the Indus and Brahmaputra. The Himalayas form India's northern frontier from Jammu & Kashmir to Arunachal Pradesh.

Himalayas run in 2400 kms. length with a width of 160 kms. to 400 kms. Their extension is between 22 longitudes. The average height is 6000 mts. It is estimated that they cover an area of 5 lakh sq. kms. Their slope towards south is convex. These are young folded mountains. They have loftiest peaks of the world. The sedimentary rocks of Himalayas are folded and faulted. They have a number of over folds, recumbent folds, nappes, and thrust faults. These are still in

the stage of formation. It has sedimentary rocks deposited in the sea, of various age. These are limited also by Nanga Parbat in the west and Namcha Warba in the east.

Classification of Himalayas

Himalayas have been divided on geographical, regional and geological basis.

(i) Geographical Division

Himalayas are a series of several ranges. These ranges are separated by deep valleys; and have a steep gradient towards the south, much gentle slope towards the north. These mountains comprise almost four parallel ranges, which are as follows;

(I) Inner or Great Himalayas- This is the innermost, the loftiest and the most continuous of the Himalayan ranges. It is defined as Himadri in ancient Indian literature. These are extended from Nanga Parbat (8126 mts) in the north-west over looking the Indus to Namcha Barva (7756 mts) in the north-east over looking the Brahmaputra. It is 2500 kms. long and 25 kms. wide on an average. The average height of the range is 6100 mts. It has eight peaks of more than 8000 mts height. Highest peak is Mt. Everest also known as Queen of mountains. It is also named as Gauri Shanker also.

The Himadri Range is snowbound throughout the year and a number of glaciers descend from it up to 2440 mts above mean sea level in Kashmir and 3960 mts in the central and eastern Himalayas. Glaciation is the most important/denudation process accounting jagged topography of this lofty range. Most of the Himalayan glaciers are 3-5kms in length but there are some giant streams exceeding 20 kmts such as Milam and the Gangotri in Kumaon and Zemu in Sikkim. These glaciers have given birth to a number of important rivers like Ganga, Yamuna and so on.

This range has a number of passes. The Burzil pass and the zoji La in Kashmir; the Bara Lacha La and shipki La in Himachal Pradesh; the Thag La, Niti pass and Lipu Lekh pass in Uttarakhand; and the Nathu La and Jelop La in Sikkim are important passes through the Himadri. The Hindustan – Tibet Road connecting Shimla with Gartok passes through shipki La in Sutlej valley. Another important trade route connects Kalimpong in west Bengal with Lhasa, the capital city of Tibet through Jelop La, the chumbi valley in Sikkim.

(2) Lesser or Middle Himalayas- This range runs in the south of Great Himalayas parallel to it. It is also called Himachal or Lower Himalaya. It forms a most intricate and rugged mountain system 60-80 kms wide and 1800-3000 mts an average height. Several peaks rising to 1500 mts height. The northern slopes are gentle and covered with dense forests in the east. Many peaks are snow covered throughout the year. These Himalayas include a number of ranges like Pir Panjal, the Dhaola Dhar, the Mussoorie Range, and the Nag Tib.

The Pir Panjal is its western extension, and occupies its Position in Kashmir. It is the longest and most important range. It extends from Jhelum River to the upper Beas River for 300-400 kms. Zaskar range separates it from valley of Kashmir. It rises to 4000mts. Pir Panjal (3494 mts) and Banihal (2832 mts) are two main passes. The Banihal pass is used by Jammu-Kashmir

highway. To the southeast of this Dhaola Dhar Range is extended, on which Shimla (2205mts) is situated. Chakrota, Mussoorie, Nanital, Ranikhet hill stations have developed on Nag Tibba Mussoorie Range. Their height is between 1500-2000 mts.

These mountains are composed of Pre-Cambrian and Paleozoic Rocks. These have slate, limestone, quartz rocks in abundance. It has noted reverse faults and folds. From tectonic point, these have been remained stable and less hostile. These are more friendly to human contact.

Valleys- Two open valleys are found between middle and Great Himalayas. In west, Kashmir valley is extended between Pir Panjal and Great Himalayas. It is 150 kms. long and 89 kms. broad. Its total area is 4900 sq. kms. and has an elevation of 1700 mts. In east, Kathmandu valley is situated in Nepal.

Views on the origin of these valleys–

- D.N. Wadia says that Kashmir valley is an exaggerated instance of a Dun or longitudinal valley.
- According to De Terra that it is a recently depressed intermost basin, pointing to marked evidence of faulting on the Himalayan flank.
- It is generally believed that this basin was occupied by a lake in the Pleistocene age. This was filled up with sediment and uplifted to form Kashmir valley. The synclinal basin of the valley is floored with a variety of alluvial deposits. Jhelum River flows through it, which has its deep gorge in Pir Panjal.

Other Valleys– In Himachel Pradesh, there is Kangra valley. It is a strike valley. It extends from the foot of Dhaola Dhar Range to the south of Beas. Kullu valley is a transverse valley. It is extended in the upper course of Ravi River.

(3) Sub- Himalayas or Siwalik- This comprises the outermost range of the Himalayas. It is also known as outer Himalayas. This chain of hills runs almost parallel to the lesser Himalayas for a distance of 2400 kms. from the Potwar Plateau in Punjab to the Brahmaputra valley in Arunachal Pradesh. The average width is between 15 to30 kms. It varies from 50 kms in Himachal Pradesh to less than 15 km in Arunachal Pradesh. The altitude varies from 600 to 1500 mts. These are known by different names, such as Jammu hills in Jammu, Dafla, Miri, Abor and Mishmi hills in Arunachal Pradesh.

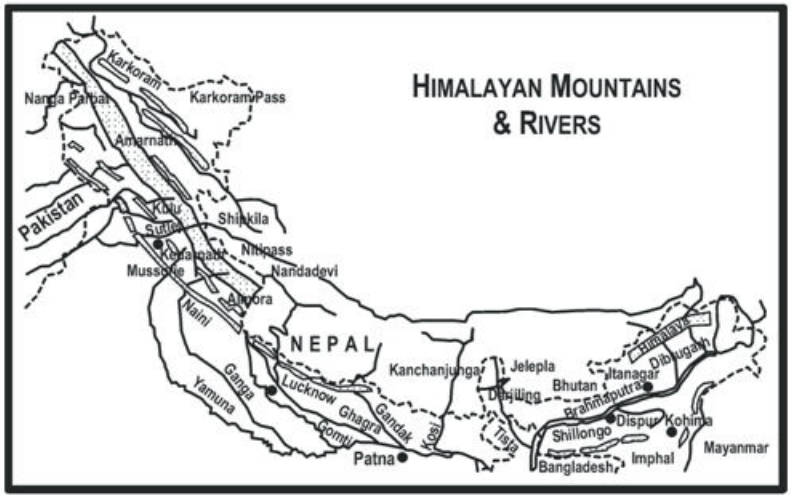
The Shivaliks are formed of great thickness of Mio-Pleistocene sands, gravels and conglomerates which have been brought by the rivers flowing from the higher ranges of the Himalayas. These have been folded, faulted and indunated by the earth movements. Obviously the Shiwaliks were formed last of all the ranges. These have very high uneven surface. The slopes are steep. Deep valleys have formed due to high erosion and landslide. Himalayan Rivers cut their course through the Shiwalik Range. These rivers crossing Shiwaliks have given the

formation to wide and at some places gorge like valleys. In west Bengal Shiwaliks have totally disappeared between River Tista and Raydok and thus form a 90 kms wide valley.

Valleys–There are found a number of valleys between, Shiwaliks and Middle Himalayas. These are like plains called 'duns' or 'Doons' in the west and 'Duars' in the east. The Duns are the discontinuous series of longitudinal vales. Dehradun in Uttarakhand is the best example of such plain which is 75 kms. long and 15-20 kms. wide. It is covered with boulder and clay deposits. It is a flat bottomed strike valley. The other Dun valleys are- Udhampur and Kotli in Jammu, Kotah, Patli, Chumbi, Kyarda, Chaukhamba and Kothri in Uttarakhand and Himachal Pradesh. These are also quite typical.

The range is covered with thick, tropical west deciduous forests in the east up to Nepal; the vegetation becomes thinner further west. The southern slopes of the range are barren and highly dissected by several seasonal streams locally called 'Chaos'.

Fig. 2.6: Himalayan mountains.



4. The Trans-Himalayas

These are extended immediately north of Great Himalayas. These were explained, by Sven Hyden in 1906 for the first time. He defined Kara-Koram Range as the 'backbone of High Asia'. The Zaskar, Kailesh, Laddakh and Kara-Koram are the main ranges of these Himalayas. It extends for a distance of about 1000 kms in east-west direction and its average elevation is 3100 mts. The average width is about 225 kms. in the central part and it remains 40 kms. at the eastern and western extremities.

These are formed of sedimentary deposits. They have the rocks of Cambrian to Tertiary Period. There is an absence of vegetation. This range gives birth to Sutlej, Sindh and Brahmaputra Rivers.

In the north of main range, Zaskar Range runs parallel to it. Its average height is 6000 mts. Beyond the Zaskar Range lies the gorge of the Indus, about 560 kms. long, 10 kms. wide and

5200 mts deep near Bunji, where the river cuts Laddakh Range. The river turns towards south-west and cuts through the Himalayas entering Pakistan about 90 kms. west of the Nanga Parbat. Further north, between the Indus and its tributary Shyok, runs Laddakh Range, which are 5800 mts high and more than 300 kms. long. It runs parallel to Zaskar Range.

Kailash Range is an offshoot of the Laddakh Range. It is extended mainly in Tibbet. North of the Indus is the great Kara-Koram a region of lofty peaks and vast glaciers. Here India's frontier is joined with China and Afghanistan. The main peaks are Mt K2 (8611mts), the second highest peak in the world, and the highest peak in India, also named as Godwin Austen by the Britishers; Hidden Peak (8068mts), Broad Peak (8047mts) and Gasherbrum II (8035mts). The largest glaciers are Hispar and Batura of the Hunza Valley over 57 kms. long and Biafo and Baltoro of the Shigar Valley, a tributary of the Indus, 60 kms. long. The Siachin glacier of the Nubra Valley is the longest one with a length of over 72 kms. The Kara-Koram Range merges into Pamir Knot towards west. It is merged in Kailash Range of Tibet towards south-east.

The Ladakh Plateau occupies the north-eastern portion of Kashmir. It has an average elevation of 5300mts. The plateau has been dissected into a number of plains and mountains. These are designated from north to south. Among these Lingzi Tang Plains, Lokzhung Mountains, Aksai Chin and Soda Plains are more prominent.

(5) The Eastern Hills or the Purvanchal

Himalayas have taken a sudden southward turn after crossing the Dihang gorge. They form a series of low hills, forming crescent shape. Their west side towards India is convex. These are extended from Arunachal Pradesh in the north to Mizoram in the south. They form India's frontier with Myanmar. These hills are known for their same origin as of the Himalayas. Patkoi are the northern hills with an elevation of 2000 mts to 3000 mts. These are merged with Naga Hills in the south. Saramati (3826 mts) is the highest peak of Naga Hills. Barail range separates Naga Hills from Manipur Hills, which are extended in the south of Naga Hills. The elevation of eastern hills decreases from north to south.

2.4. 2 GREAT PLAIN OF INDIA

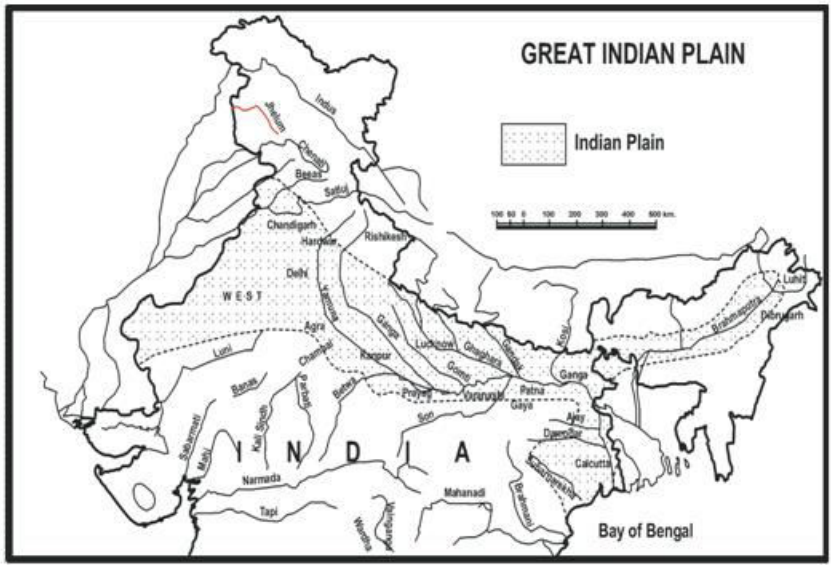
This plain lies between the Himalayas in the north and Peninsular Plateau in the south. It is an aggradational plain. It is a part of Indus-Ganga-Brahmputra Plain. It is known as most densely populated and most fertile plain of the world. It covers a total area of 7.8 lakh sq. kms. Its average width varies from 150 to 300 kms. It is widest in the west where it stretches for about 500 kms. Its width decreases in the east and reaches to 145 kms.

It is a monotonous plain. The average elevation is about 200 mts above mean sea level. Its highest elevation is 291mts between Ambala and Saharanpur. It is a watershed area, separating the drainage system of the Ganga from the Indus. Politically; it extends as the lands of Rajasthan, Haryana, Punjab, Delhi, Uttar Pradesh, Bihar, West Bengal and Assam.

Origin and Formation of the Plain

It is almost universally accepted that this vast plain is the result of great depositions of deep depression lying between the Peninsular and the Himalayas. It is formed after the Himalayan Orogeny. The alluvial deposits are so deep, that it is very difficult to ascertain its actual depth. According to some experiments, the average thickness of alluvium is 1300 to 1400 mts. This thickness is higher between Delhi hills and Rajmahal hills. These have lesser thickness on its western and eastern margins. Thus, it is very difficult to ascertain the depth of the fore deep, on which, the depositional work took place.

Fig. 2.7: Extent of great Indian plain.



Origin of Foredeep

Divergent views have been expressed regarding the origin of this great depression and the process of filling it. One of the groups of scholars is of the view that this foredeep is in the form of geosyncline. It was a remnant part of Tethys Sea. The eastern part of this geosyncline has been named as Eastern gulf and the western part, as Gulf of Sind Edward Suess, the famous Austrian geologist is of such opinion. He suggested that a fore deep was formed in front of the Himalayas. It couldn't further extend in south due to inflexible solid landmass of the Peninsula. It was like a syncline, which was filled up by the Himalayan Rivers mainly.

The another group of scholars is of the view that this foredeep is just like a great deep rift or fracture, which was formed at the time of the elevation of the Himalayas. Sir Sydney Burrard has concealed that a fracture in the earth's sub-crust, several thousand metres deep and 2400 kms. long took place at the time of elevation of Himalayan chain. He has supported his view by giving examples of some other rift valleys of the Himalayas as well as the rift valleys of Narmada and Tapi in the Peninsular India.

Most of geologists do not agree with this view. They are of the opinion that there are no evidences of a rift valley at the northern edge of the Peninsula. Any how, there is no doubt that the Great Plains represent the infilling of a foredeep warped down between Peninsular Block and the advancing Himalayas. These have been formed by the deposition detritus of the mountains by the numerous rivers emerging from them during a period of great gradational activity.

Geomorphic Divisions of the Plain

This plain is so monotonous, feat and featureless; it is very difficult to put the plain into a number of divisions. Its surface is not more than 300 mts high from the mean sea level. The average gradient of slope between Saharanpur and Kolkata is 20 cms per kms. It declines towards the middle and lower valley of River Ganga. After Varanasi up to Ganga delta, the average slope is 15 cms. per Kms. On the basis of nature of relief and soil structure the following divisions can be marked in this Great Plain.

(i) The Bhabhar Region- The Bhabhar is a piedmont plain. It is composed of unsorted debris from the Himalayas. It forms the northern boundary of the Great Plain. The porosity of the pebble studded rock beds is so high that most of the streams sink and flow underground. Therefore, the area is marked by dry river courses except in the rainy season. Though, it is a narrow belt about 10 to 15 kms. wide running in east-west direction but it is comparatively narrow in the east and extensive in the western.

(ii) The Terai Region- It is a 15-30 kms. wide marsh tract in the south of Bhabhar running parallel to it. The water of underground streams of the Bhabhar belt is reemerged here. It is a low lying plain characterized by finer sediments, natural forest cover, emergent and ill defined water channels, low gradient and high water table resulting in swamps and marshes. Most of the Terai Region has been reclaimed and turned into the cultivation of rice, sugarcane and wheat.

(iii) Alluvial Region- The Great Plain is the product of alluvial soils. It is generally stiff clay with low sand content. This alluvium is of two types:-

(a) Bangar Alluvium- These are old alluvium, which were formed during the middle to upper Pleistocene age. These form the higher ground in the interfluve areas above the general flood limit. The colour is green. It is often composed with Calcareous concretions known as Kankar. These are highly fertile.

(b) Khadar Alluvium- It is composed of newer alluvium. It forms flood plains along the river banks. A new layer of alluvium is deposited by river flood every year. These deposits are of the age of upper Pleistocene and Recent period. The colour is light. These are good storage of underground water. The clays have Kankar and sand. These are quite fertile and are normally renewed every year, denoting the increase in fertility.

(iv) Reh- This is spread in those Bangar areas where the irrigation has the dominance. It is known as the white layer of saline efflorescence's. It is widely extended in drier areas of Uttar Pradesh, and Haryana. It is also known as Kallar.

(v) Bhur- It denotes an elevated piece of land situated along the drain areas of Ganga and Ramganga Rivers. This has been formed due to accumulation of wind-blown winds during the hot dry months of the year. In real sense, these are dunes of sand.

(vi) Deltaic Region- These are formed on the mouth of rivers. Ganga-Brahmputra Delta is quite large and is extended on the lands of India and Bangladesh. The old delta is in India.

This Great Plain is badly eroded by the rivers on its southern margins especially between Chambal and Son Rivers and thus is known as 'Bad Land'.

Sub-divisions of Great Plains

On the basis of direction of flow of rivers and distinctive surface features in different parts, this plain can be divided into four major sub-divisions:

1. Rajasthan Plain- This is the western extremity of the Great Plain and is extended on an area of 1.75 Lakh sq. kms. It covers western Rajasthan and is delimited by Aravalli Range in the east and Pakistan in the west. It is the part of Marusthali Marwar Plain. This desert is an undulating plain. The average elevation is about 350 mts. Its slope is towards south and west. It has vast stretch of sand with a few outcrops of bedrock of Gneiss, schists and granites. Such rocks prove the geologically that it is a part of the Peninsular Plateau, and gives an evidence of aggradational plain. Sand dunes cover a large area. The southern and western parts have mostly longitudinal plains. The eastern and southern parts, where ever the wind is strong, barkhans and transverse dumes are common. The steppe land of the Bagar runs, in a north-east to south-west direction from the north-eastern edge of the Aravalli to the 25 cms. isohyets in the west.

The main River is Luni. It has its basin in the south with a height of 150 mts. The topography is marked by a few hills of hard rocks. The Luni is a seasonal stream flowing towards south-west of the Rann of Kutch. The north area of Luni Basin has inland drainage with a number of lakes like Sambhar, Didwana, Lun Karansar, Kuchaman and Degna. The Sambhar Lake is the largest. It covers 300 sq. kms. area and is extended at a distance of 65 kms. west of Jaipur.

2. The Punjab-Haryana Plain- It is also called Sutlej-Yamuna Divide. It is extended on Punjab, Haryana and Delhi states. Sutlej, Ravi and Beas are main rivers. Between Sutlej and the Yamuna, the Ghagghar a seasonal stream is important. River Saraswati was perhaps an important perennial river in the past, it disappeared with the change in climate.

This entire plain extends for a length of 640kms. in north-west to south-east direction and is about 300 kms. wide in east-west direction. The total area of this plain is above 1.75 lakh sq.kms. It is bounded by River Yamuna on the east. On south-east Aravalli Ranges are ended near Delhi. The average height of the plain is 250 mts. It varies from 300m in the north to 200 mts in the south-west. The area has two regional slopes, westwards to the Indus Plain and southwards to the Rann of Kutch. The Ravi, the Beas and Satluj form Doabs the land between two rivers. The land between Ravi and Beas is called upper Bari Doab, the land between Beas and Sutlej as Bist

Doab; and the land in the south of Sutlej is known as Ghagghar Plain. This Ghagghar Plain has developed as a fertile plain because of irrigation facilities.

3. The Ganga Plains- This Plain covers an area of 3.57 lakh sq. kms. of Uttar Pradesh, Bihar and West Bengal. The slope is west to east and to south east. The Ganga is the main stream of the region. The important tributaries are the yamuna and Son on its right bank and the Ghaghra, Gandak and Kosi on the left bank. All through its course in the plains, the river is a braided stream by low-lying depressions which get flooded during rains. Bhangar and Khadar are its two main physiographic variations. Dead arms of rivers, filled up with water are called Beel. It has three main sub-divisions:-

(i) Upper Ganga Plain- It is bounded by Shiwalik Hills in the north, Peninsular Plateau in the south, River Yamuna in the west and 100 metre contour in the east. The average height is between 100 and 300 mts. The slope is steep in north as compared to south and east parts. Yamuna, Ganga, Ramganga, Sharda, Gomti, Ghaghra are the main rivers.

(ii) Middle Ganga Plain- It is extended on east U.P. and Bihar. It is bounded by 100 mts. contour in the west, which follows Allahabad-Faizabad Rail Line, 75 mts contour on the east and 30m contour line on south-east. The plain is highly affected by the shifting of courses of rivers, causing floods. Kosi is a bad name, and called Borrow of Bihar. Ghaghra, Gandak, Kosi and Ganga are main rivers. It has great occurrence of Khadar land. Kankar formation is less. It is highly fertile. It is decorated with ox-bow lakes and dead arms of rivers. Floods are the regular feature.

(iii) Lower Ganga Plain- It includes the whole of West Bengal excluding Purulia district in the west and the hilly parts in the north. It is extended from the foothills of Himalayas in the north up to Ganga Delta in the south. It is drained by Tista, Jaldhaka and Torsa rivers. The plain is narrowed down near Raj Mahal hills; it is formed in Pleistocene period and subsequently up warped and eroded into terraces. Its most of the part is composed of recent alluvium. The level in the south is very low below 50 mts. The seaward face of the delta is strongly influenced by tidal estuaries resulting into a maze of sand banks, mud flats, mangrove swamps. It is covered with tidal forests called Sunder bans.

(iv) Brahmputra Plains- This is also known as Assam valley. It is low level narrow plain lying between Meghalaya Plateau and Himalaya Mountain. It is 80 Kms. broad. The valley is built-up mostly by the aggradational work of the Brahmaputra. The height is 130 mts in the east, and 30 mts in the west. The average slope is 12 cms. per km. The direction of slope is towards south-west. Terai and semi-terai regions exist on the northern fringe of the Plains. These are covered with swampy soil and dense forests.

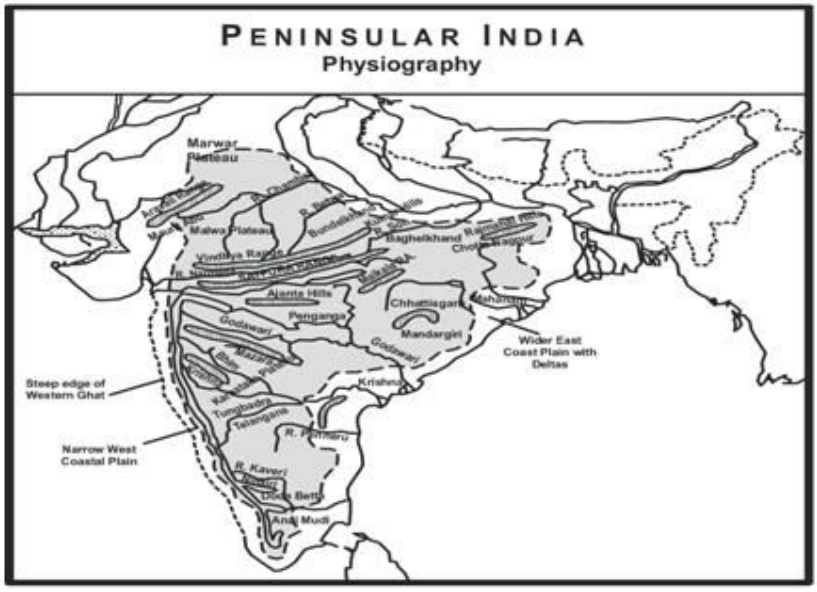
This Plain is the soul of India. It is most densely and prosperous part of the country. It plays a great role in the economy of India. This has high significance for agriculture, trade, industry and transport.

2.4.3 THE PENINSULAR PLATEAU

These uplands are morphologically polygenetic and complex; relatively a stable landmass extends from the southern margin of the Great Plains up to the coastal margin of the country. The entire plateau measures about 1700 kms. in north-south and 1400 kms. in east-west direction. It covers a total area of about 16 lakh sq. km., and is the largest physiographic unit of India. The average height is 600-900 mts. The general slope of the plateau is from west to east with an exception of Narmada and Tapi rift valleys which slope westwards.

This Plateau occupies south-east Rajasthan, Madhya Pradesh, Chhattisgarh, Odisha, Maharashtra, Gujarat, Karnataka, Telangana, Andhra Pradesh, Tamilnadu and Kerala. From the natural point, its north boundary is formed by Aravalli, Kaimur and Raj Mahal Hills, on its west Western Ghat and on its east Eastern Ghat have its limitation. It is an ancient tabular block composed mostly of the Archean gneisses and schists. It has a number of evidences of structural changes. Some scholars are of the view that Meghalaya Plateau, Rajasthan Desert are the part of it, undoubtedly, the entire plateau is an aggradation of several small plateaus and hill ranges interspersed with river basins and valleys. A brief of all these features of the plateau will help us to understand the relief of this great plateau.

Fig. 2.8: Some physiographic features of Indian peninsula.



The Plateaus

Narmada and Son Rivers have dissected it in a number of plateaus. It has four main plateaus:-

(i) Malwa Plateau- This Plateau has complex geology. It is formed of lava and covered with black soils. The slope is towards north. Betwa, Parvati, Neewaj, Kali Sindh, and Chambal Rivers drain it. The general height decreases from 600 mts in the south to less than 500m in the north.

There are rolling plains and flat topped hills. The northern part of the plateau has been converted into ravines by River Chambal.

(ii) Bundelkhand and Baghelkhand Plateaus- The north-east part of Malwa Plateau is known by this name. It disappears near the Yamuna Plain in the north. It is extended between Gwalior Plateau and Vindhyachal Range. It is formed by old Bundelkhand gneiss. It has river terraces. The elevation is between 300 and 600 mts. The number of hills and dunes of sandstone and granite are found in scattered form.

Baghelkhand Plateau is extended in the east of Kaimur and Bharner hills. It is made up of limestones and sandstones on the west and granite in the east. The central part of the plateau acts as a water divide between the son drainage system in the north and the Mahanadi river system in the south.

(iii) Chhotanagpur Plateau- It is situated in the east of Baghelkhand, separated by River Son, flowing in north-west and joins the Ganga. Mahanadi, Swarn Rekha and Damodar are the other main rivers. Damodar River flows through the middle of this region in a rift valley from west to east. It has large deposits of Gondwana period. Mahanadi forms its southern limit, and flows in south-east direction. Raj Mahal Hills form the north eastern edge of the plateau. These are mostly made of basalt.

This Plateau virtually consists of a series of plateaus standing at different levels of elevation. Hazaribagh, Kodarma and Ranchi are the other main plateaus. The average elevation of Ranchi Plateau is 700 mts. Most of the surface is rolling where Ranchi city is located. At places it is interrupted by Monodnocks and conical hills. This plateau is known as storehouse of minerals. Bauxite, mica, and coal are the main minerals, found in abundance. It is also rich in forest wealth. Sal, teak, jamun, shisham, bamboo are the main trees. Hilly slopes and river valleys are known for rice cultivation.

(iv) Meghalaya Plateau- The rocks of the peninsular plateaus are extended beyond the Rajmahal hills, and form a rectangular block known as Meghalaya or Shillong Plateau. Garo-Rajmahal gap has separated it. This gap is the result of down-faulting, which was filled by sediments deposited by the Ganga. This plateau is formed of the Garo hills (900mts) in the west and Khasi-Jaintia Hills (1500mts) in the east. These hills slope towards north to the Brahmputra valley and towards south to the Surma and Meghna Valleys. Cherapunji is situated in the south of Khasi Hills.

All the other Plateaus of the Peninsula are extended in the south of Narmada and Mahanadi Rivers. Among them Deccan Plateau is the main. Telangana and Karnataka Plateaus are extended in the southern part.

(v) Deccan Plateau- It is also known as Maharastra Plateau. Much of the region is underlain by basaltic rocks of lava origin. It covers an area of 5 lakh sq. kms., and includes the parts of Madhya Pradesh, Chhatisgarh, Maharastra, and Gujarat. Thus, it is delimited by Amar Kantak

and Sarguja in the east, Kutch in the west, Belgaum in the south and Rajmahindry in the south-east. River Tapi forms its north limit, the Western Ghats are found in the west.

The depth of lava is upto 2000 mts. This depth declines from west to east. The slope is from north-west to south-east. The broad and shallow valleys of the Godavari, the Bhima and Krishna are flanked by flat topped steep sided hills and ridges. Here, igneous rocks, sandstone limestone, and coal are the deposits of Gondwana Period. These rocks are rich in minerals. Iron ore, manganese, gold, mica, Magnesite, and Bauxite are the main minerals. The entire area is covered by black cotton soil known as regur.

(vi) Telangana Plateau- It covers most part of Telangana state. Godavari River has divided it into two regions, namely the ghats and rolling plains. The northern part is of hilly nature and is covered with forests. River Wardha has its flow on it. The southern part is pen plain in nature. It has given birth to a number of big towns like Hyderabad and Secundrabad.

(vii) Karnataka Plateau- It is extended in the south of Maharastra. The 600 mts contour line divides it into two parts- (i) The Northern Part- It contains the head of the Tungbhadra and Kaveri River. Here Ghat Prabha and Mal Prabha Rivers join Krishna on its right bank. (ii) The Southern Part- It is known as Mysore Plateau. It is made up primarily of the Archean formations. It has rolling surface with an average elevation of 600-900 mts. It has its slope towards east.

This plateau is highly dissected. The plateau is divided into two parts called Malnad and Maidan. The Malnad in Kannada means hill country. It is dissected into deep valleys covered with dense forests. The Maidan is formed of rolling plain with low granite hills. The entire plateau tapers between the Western Ghats and Eastern Ghats in the south and merges with the Nilgiri Hills there.

Hills Ranges and Mountains of Peninsular Plateau:

The Plateaus of this peninsula are separated from one another by hill ranges and river valleys. Most of these hills are relict type. These are remnants of the original higher hills. The main hills are as follows:-

(i)The Vindhyachal Mountain Range- It extends more or less parallel to the Narmada valley in an east-west direction from Gujarat to Sasaram in Bihar. The total length in 1200 kms. The general elevation is 300 to 750 mts. This range is a combination of Vindhyachal, Bharner, Kaimur and Parasnath Hills. It is composed of horizontally bedded sedimentary rocks of ancient age. Red sandstone is the most dominant rock. This range acts as a watershed between the Ganga system and the river systems of south India. It rather separates North India to South India. The northern slope of this range is rather gentle, but the southern slopes are marked with spurs, steep falls and valleys.

(ii) Satpura Mountain Range- its name is derived from Sat (seven) and Pura (mountains). Therefore, it is a series of seven mountains. It runs in an east-west direction south of the Vindhyas and in between the Narmada and Tapi, roughly parallel to these rivers. It commences

from Rajpipla Hills in the west and further in the east and north-east direction extended through Mahadev and Maikal Hills. In east, it is submerged in Rajmahal Hills. It is composed of mainly Basalt and Granite Rocks. The average height is 760 mts. The highest peak of this range is Dhupgarh (1350 mts) near Pachmarhi on Mahadev Hills. Amarkantak is the second highest peak with a height of 1066 mts. Narmada River takes it origin near to the peak. It has number of waterfalls. The main water fall is Dhuandhar on River Narmada near Jabalpur. Marble stone rocks are found here. Satpura Range is an escarpment on its north.

(iii) Aravalli Hills- It runs in north-east to south-west direction for a distance of 800 km. between Delhi and Palanpur (Gujarat). They represent the relict of the world's oldest fold mountain system. The range is mostly composed of quartzites, gneisses, and schists of the Pre-Cambrian age. The average height is between 300 and 900 mts. In the north it is lower than 400 mts near Delhi. Here, these are known as Delhi Hills (304 mts). It is supposed to continue further north up to Hardwar buried under the alluvium of the Ganga Plains. In the south, it fans out into several ridges, most of them rising to above 900 mts. The highest point is reached at the Gurusikhar Peak (1722 mts) in the Abu Hills. Near Udaipur, these are known as Jarga Hills and near Alwar as Harsh Nath Hills. This range functions as Water-divide. Mahi and Luni on its west, flows to Arabian Sea. Banas, a tributary of Chambal, is on its east. All these are seasonal rivers. These are the oldest folded mountains of the world. A number of scholars have forwarded their views on its origin.

1. According to Most of Geologists- These are the oldest and are extended part of the high mountains. These have their origin in the form of Fold Mountains during Vindhyan Period. These mountains are highly affected by the processes of denudation. So, these are called mountains of circum-denudations.

2. A.M. Heron- These Hills are probably the oldest hills of the world, which still exist today.

3. Fermor- This is a horst type of mountain.

4. D.N. Wadia- The Aravallis extended as a continuous chain of lofty mountains from Deccan to possibly beyond. Present Aravallis are eroded remnants.

5. M.S. Krishnan- Aravallis were extended upto Lakshadweep Archipelago.

Aravallis are made by hard quartz rocks. These are known for lead, Copper, Zinc, Manganese, Asbestos, Marble stone and Mica Minerals.

(iv) Western Ghats- These are also called Sahayadris. These form the western edge of the Deccan tableland. They run in north-south direction, parallel and close to the Arabian Sea Coast from Tapi Valley (21oN) to a little north of Kanyakumari (11oN) for a distance of 1600 kms. The Western Ghats abruptly rise as a sheer wall to an average elevation of 1100 mts from the Western Coastal Plain and appear to be a imposing mountain. They slope gently on their eastern flank. They are composed of horizontally bedded lavas. These Ghats have high surface variations.

The north Sahyadri extends from Tapi River to the origin of Malprabha River, with a length of 650 kms. Gadavari, Bhima, Krishna and Ura Rivers are originated from this area. Thalghat and Bhorghat are two main passes. Thalghat is at 581mts height and provide passage to Kolkata, while Bhorghat is at 630 mts height connect Pune with Mumbai.

Middle Sahyadri runs between Malprabha River origin and Palghat pass. It is 650 kms. long. This part is made of granites and gneisses and present rougher topography. It is covered with dense forests. The average height is 1220mts. The main peaks are Kudra Mukh (1892mts) and Pushpagiri (1714mts). Tungbhadra and Kaveri Rivers drain this area. Here, Nilgiri Hills mark the junction of the Western ghats with Eastern ghats. Doada Betta (2637mts) is an important peak of the area.

South Sahyadri is extended from Nilgiri Hills to Kanyakumari upto a distance of 290 kms. Here, Palghat Gap is a prominent break in its continuity. The gap is only 24kms. wide at its narrowest point and 144m high. It gives passage to Tamilnadu from Kerala. In the south of Palghat gap, there is an intricate system of steep and rugged slopes on both sides of the ghats. Anai Mudi (2695mts) is the highest peak of South India. Palni Hills are in north east and Cardamom Hills are in south.

Western Ghats present a very youthful topography. The rivers flowing eastward have broad valleys.

(v) Eastern Ghats- These form the eastern boundary of the Deccan Plateau. They are extended from the south of River Mahanadi upto Nilgiri Hills in a length of 1300 kms. in North-east to south-west direction. They have lost their own existence after Nilgiri Hills. The average height is 615mts. In north, the width is 190 kms, while in south it reaches to 70 kms. These Hills have been badly eroded by rivers. They exhibit a true mountain character between the Mahanadi and Godavari. The average height in this section is 920mts. The highest point (1680 mts) is in the Visakhapatnam district. Mahendragiri (1501mts), the second height, is in the Ganjam district of odisha. The ranges are principally composed of Khondalites and Charnokites and covered with dense forests.

These hills have been quite disappeared between Godavari and Krishna Rivers deltas. They appear again as continuous ranges in only the Cuddapah and Kurnool districts of Andhra Pradesh. These ranges, here are known as Nallamalai Hills, 900-100 mts high, composed of quartzites and slates,the southern part of these hills is called Pal Konda Range.

Further south in Tamilnadu, these hills become confusing, and have number of ranges in west and south-west direction. They are called Javadi Hills in North Arcot district, Gingee Hills in South Arcot district, Kollaimalai and Pachaimalai in Tiruchirapalli district, Shevroys and Gondumalai in Salem district and Biligiri Rangan Hills in Coimbatore district, which join Nilgiri Hills. Here the height is 1279 mts, composed mostly of Charnockites. Melagiri Range between Kaveri and Pinar Rivers is famous for the sandalwood and teak forests. Here, Kaveri River forms Hozekal waterfall.

Other Geomorphic Features:

(i) Narmada Valley- It is a rift valley. It lies between Vindhyachal Range in the north and Satpura Range in the south. This valley plain is 322 kms. long and 35 to 56 kms. wide. It is 152 mts high from mean sea level. It is in the form of structural depression.

(ii)Tapi Valley- It is extended in the south of Satpura Ragne. Its plain is 240 kms. long and 50km. wide. It is 304 mts high from mean sea level and is also in the form of rift valley.

(iii) Kathiawar and Kutch Peninsulas- It is a bag type peninsula, which has been separated by alluviums of Gujarat from Peninsular Plateau. It is mostly composed of Deccan lavas, while tertiary rocks predominate in the Kutch peninsula, which is characterized by small folds, dissected plateaus and scarp lands. The northern most part of Kutch peninsula is known as Rann of Kutch. It is a subsided surfaced covered with mud flats and salt marshes flooded during the rains. The most part of Kathiawar Peninsula is composed by sand dunes. The midpoint of this peninsula has Girnar and Gir Hills. The Girnar peak is the highest peak with a height of 1117mts.

In conclusion, it may be said that there is a great variety of physical features in peninsular India. Though, this plateau is poor in forest resources, yet it is rich in minerals and is regarded as the 'storehouse of minerals'.

2.4.4 COASTAL REGIONS

The coastal line of India is 5686 kms. long. If we add to this coastline of our islands, the total coastline stretches to 7515 kms. The Coastal Plains run from Rann of Kutch in the west to the Ganga-Brahmputra delta in the east. The area between the Western Ghats and the Arabian Sea Cost is known as West Coastal Plain and that between the Eastern Ghats and the Bay of Bengal Sea Coast is called the East Coastal Plain. These two Coastal Plains may be put as follows:

1. Western Coastal Plains:

This is a narrow coastal plain. It is extended from Rann of Kutch to Cape Camorin. It has an average width of 64 km. Here, the rivers are small and swift. It can be divided into four sub-divisions:-

(i) Kutch Peninsular Coastal Plain- Kutch is an island. Rann of Kutch is a shallow bay that is joined with the mainland in dry season, but in rainy season, it has its own identity. It is a salty sandy plain interspersed with rocky hills. The Rann gets flooded during the rains.

(ii) Gujarat Plains- It is formed by the Sabarmati, Mahi, Narmada and Tapi Rivers. The Plain includes the southern part of Gujarat and the Coastal areas of the Gulf of Khambhat. This is a low plain. It is 12 mts high only near the mouth of Sabarmati. A chain of saline marshes near the coast is prone to floods during high tide.

(iii) Konkan Plains- This extends from Daman to Goa in a length of 500 kms. The width varies from 50 to 80 kms. It has some features of marine erosion. The Thana creek of the Ulhas around

Mumbai Island is an important embayment, which provides an excellent natural harbor on the southern side of the island. The slopes of western coast of Konkan have black soils, which are known for Sal and Teak forests. It has a series of small bays and coves lying between jutting head lands containing beaches of sand. The coconut trees are found near the coast of these small bays. It is known for Rice and Mango because of heavy rains.

(iv) Malabar Coastal Plains- This plain is extended from Goa to Manglore in a length of 225 kms. It is a low undulating plain. It is composed by old metamorphic rocks. It is more open and level than in the north. It has lateritic hills. The Mandovi-Zuari creek in Goa is an important embayment in the Coastline. Marine topography is quite marked on the coast. It is known for the luxurious growth of banana, mango, coconut, rice, betel nut, and spices.

(v) South Coastal Plains- This is mainly of Kerala Coast, which is extended between Manglore and Kanyakumari in 500 kms. length. This is much wider coastal plain. It is a low lying plain with the height of not more than 30mts. the existence of lakes, lagoons, backwaters, spits etc. is main characteristic of this coast. The backwaters locally known as Kayals are the shallow lagoons or inlets of the sea, lying parallel to the coastline. These lagoons or lakes have been joined together by the canals, which are used for travel and trade. Kochchi port is also located on one of such lake. This coast is very popular for fishing, coconut, rice, betel nut, banana and spices are grown on the lands of this coast.

2. East Coastal Plains

These are extended from mouth of Subarna Rekha to Kanya Kumari and are much wider and contain many prominent deltas. A major part of the plains is formed as a result of alluvial fillings. It is also known for the long series of sand deposits on the coastal areas, which are brought by sea waves. These sand deposits are responsible for the formation of Chilka and Palicut lakes. The inner part of the coastal area is the residual plain of alluvium, which is the product of denudation of upper areas. This coast is also known as Coromandal and North Circar Coast, which has its three main sub-divisions:

(i) The Utkal Plain- It comprises coastal areas of Odisha, and is 400 kms long. This costal line is straight and smooth. Most important physiographic features are Mahanadi delta and Chilka Lake. The coasts are much wider near Mahanadi delta. Chilka Lake is in the South of the delta, which is 75 kms. long. It is cut off from the Bay by a long spit of sand, hills enclosing it on the south and west. Here, Visakhapatnam port is a safe port in the back of Dolphin Rock. It has good facilities of shipping because of deep water. This plain has also the presence of a number of small rivers. Their mouths have a number of ports, which play an important role in coastal trade and fishing. The coastal and deltaic lands are known for jute and rice cultivation.

(ii) The Andhra Plain- It is extended along coast of Andhra Pradesh. The combined delta of the Krishna and Godavari is situated here. The Kolleru Lake is situated between the deltas of the two rivers. It marks the coast line of the past indicating the seaward advance of the deltas. The plains extend upto about 100 kms. In land along the Krishna. Pulicat Lake, 40 kms north of Chennai is

a typical lagoon. It is separated from the sea by Sriharikota Island, an old beach ridge. This island is known for satellite launching station of ISRO.

(iii)The Tamilnadu Plain- It is extended in a length of 675 kms. from Lake Pulicat to Kanyakumari along the coast of Tamilnadu and Puddudery. Its average width is 100 kms. Near Kaveri delta, the width is 130 kms. This delta is very fertile and is known as granary of South India. In the Gulf of Mannar, between Tamilnadu and Sri Lanka, there are several tiny coral islands.

2.4.5 INDIAN ISLANDS

Apart from the large number of islands in the near proximity of the Indian coast, there are 247 distant islands, of which 222 islands are situated in Bay of Bengal and the remaining in Arabian Sea. The islands of both of these differ to each other. The Arabian Sea Islands are the founder remnants of the old landmass and subsequent coral formations. The Bay of Bengal Islands represent surfaces of the Tertiary fold axis. All these islands have been put into two main categories on the basis of their location from the coast. The islands, which are at a distance of 1 to 5 kms from the coast, are defined as off-shore Islands, whereas those islands which are away from the coast i.e. more than 5 kms are defined as Distant Islands.

1. Arabian Sea Islands

These extend from Gulf of Cambay to cape Comorian. They have Coral origin and are surrounded by fringing reefs. Here off-shore islands are mostly found near Kathiwar of Gujarat, gulf of Khambhat, near the estuaries of Narmada and Tapi and along the coastal areas of Maharasrtra, Goa and Karnataka.

The distant islands are Lakshadweep Islands. Literally means one lakh islands. Actually it is a group of 25 islands. Previously, these were known as Lakkadiv, Minicoy and Amendivi Islands. These are situated at a distance of 200 to 300 kms. from the western coast of India, and are extended between 80o to 120o N Latitudes and 71o to 74o E longitudes. The total area of these islands is 32 sq. km. Lakshadweep is the biggest island. Kavarpatti the capital of these islands is situated here. Amindivi is a small island. Minicoy is the island of extreme south, and is situated on 8o latitude. The area is 4.5 sq. kms. These islands are known for Coconut groves.

2. Bay of Bengal Islands

These are situated nearly at a distance of 220 kms from the mainland. These (mainly andman group) are extended in crescent shape in length of 590 kms and a maximum width of about 58 kms. They are developed in group, and are separated to each other by narrow bays. The coasts are of teeth shape which provides safe harbor for the ships. There are two main groups of these islands.

(i) Off-shore Islands- Such islands are more in number near Gangetic Delta. These are the evidences of alluvium deposits. Ganga Sagar is the longest island on the mouth of Hooghly. It is 20 kms. long. New Moore Island is recently formed. Mahanadi Brahmini Delta has also the

presence of such islands. Pamban Island is situated between India and Srilanka. It is an extension of the peninsular surface in the Ramanathapuram district of Tamilnadu. A bridge carrying a railway line between Ramnathanpuram and Dhanushkoti connects it to the mainland. Sri Hari Kota Island is situated near Nellore.

(ii) Distant Islands- These include Andaman and Nicobar group of islands, which are as follows-

(a) Andaman Islands- These are extended in a length of nearly 300 kms between 92o20' E to 93o20' E longitude and 10o20' N to 14o N latitudes. It includes north, middle south and little Andaman's. These form a group of 203 islands. These are separated by Ten Degree channel from the Nicobar group in the south. Andaman Islands are spread in an area of 8300 sq. kms. These are formed by sandstone, limestone and shale of Tertiary period. These islands have rugged topography, with dense vegetation.

(b) Nicobar Islands- This group consists of 19 islands extended between 6o30' N to 9o30' N latitudes. They are scattered over a length of 262 kms. with a maximum width of 58 kms covering an area of 1653 sq. km. The great Nicobar of north is the largest island having an area of 168 sq. kms., while the south nicobar has an area of 200 sq. kms. The Southern most islands are only 147 kms. away from Sumatra island of Indonesia. The south most point of Nicobar is known as Indira point.

It is assumed that these distant islands are the remnant peaks of submerged mountains which were extended at the time between Arakan Yoma and mid-mountain range of Sumatra Island. The Barren and Narcondam islands, north of port Blair, are volcanic islands. Some of the islands are fringed with coral reefs. Many of them are covered with thick forests and some are highly dissected. Most of the islands are mountainous and reach to considerable height. Saddle Peak (773mts) in North Andaman is the highest peak.

2.5 SUMMARY

Geology of India is quite ancient, complex and varied. It has the rocks of Pre-Cambrian to the recent times. Peninsular India is made by old to oldest rocks. Himalaya's rocks are younger than peninsular rocks and Great Plains have most young rocks. Indian rocks are put into four groups. These groups are composed by various systems. Pre-cambium rocks have Archean and Dharwar systems. Archean system is the system of oldest rocks. Dharwar Rocks are the dust of Archean system and are known for the deposits of valuable minerals. Purana group of rocks is formed by Cuddapah and Vindhyan system. Cuddapah system is very economically significant than Vindhayan rocks. These have the deposits of limestone, red sandstone, and fine clay. These rocks are basic materials for cement industry and building construction. Dravidian rocks system gives an evidence of beginning of life on the earth.

Rocks of Aryan group belong to the systems of Gondwana, Deccan traps, tertiary and quaternary. Gondwana system is known for coal deposits of India. These possess 98 percent of

our coal reserves. This system experienced the luxurious growth of vegetation due to hot and wet climate. Deccan traps are hard rocks and their weathering has produced black fertile soil. These traps have variations in their thickness. Tertiary system is responsible for Himalaya's formation. This system has the rocks of Eocene, Oligocene, lower Miocene and mio-pliocene system. All these systems have helped in the formation of Himalayan ranges. Rocks of quaternary system include Pleistocene and recent rocks. Flanks of Pir-Panjal and Kashmir valley have riverine deposits. Indo-gangetic alluvium is the deposition made by rivers. The coastal alluvial deposits are also of Pleistocene age.

Indian physiography is of diverse nature. There are five main physiographic regions. The Himalayan Mountains, the great plains, the peninsular plateau, the Indian coasts and the islands.

Himalayan mountains are extended between the gorges of Indus and Brahmaputra. It forms our northern frontier. It has 2400 kms. length. The average height is 6000 mts. These are young folded mountains. It in made up by sedimentary rocks. It has three geographical divisions. Great Himalayas are the loftiest. These are snow-bound throughout the year. It has the origin of a number of important rivers like Ganga, Yamuna, Jhelum, Chenab, Ravi, Beas, Kosi. It has also a number of passes and glaciers. Lessar Himalayas form the parallel range of great Himalayas. It has a number of ranges. Pir Panjal is its western extension. It has open valley of Kashmir. It is the longest and most important range. Pir Panjal and Banihal are two important passes. Siwaliks are the outer most range of the Himalayas. The altitude varies from 600 to 1500 mts. These are made by sands, gravels and conglomerates. These are disappeared at several places by the erosion of rivers. Dun valleys are developed between Siwaliks and lesser Himalayas. Trans-Himalayas are extended north of great Himalayas. These have parallel ranges of Zaskar, Laddakh, Kara-Koram and Kailash. The K2, the second highest peak is situated on Kara-Koram ram. Purvanchal hills form the north-east frontier with Myanmar.

Great plains are an aggradational plain. It is monotonous in nature. Sutlej Yamuna divide is a watershed area. This plain is the result of the deposition of alluvium in the depression brought by rivers from the Himalayas. The alluvium has a great depth. On the basis of nature of relief and soil structure it is divided into Bhavar, Terai, Bhangar and Khadar alluvium, reh, bhur and deltaic alluvium. Bhangar is an old alluvium, and is highly fertile on the basis of flow of rivers and distinctive surface features; it is divided into Rajasthan plain, Punjab-Haryana plain, Ganga plain and Brahmaputra plain. Ganga plain is the most extensive. Here, Ganga is the main river. It is most fertile and densely populated. It has three sub divisions upper, middle and lower. There plains are the soul of India.

The Peninsular plateau, a stable landmass is extended from the southern margins of the Great Plains up to the coastal margins of east and west. It is aggradations of several small plateaus, and hill ranges interspersed with river basins and valleys. Malwa Plateau is covered with black soils. Bundelkhand and Baghelkhand Pleateau make the north limit of the plateau. Bundelkhand pleateau has number of hills and dunes of sand. Baghelkhand Plateau is made up of limestones and sandstones. It acts as a water divide. Chhota Nagpur Plateau is a series of

Plateaus. It is the store house of minerals and forest resources. Meghalaya Plateau is formed by Garo, Khasi and Jaintia hills. Deccan plateau is known as Maharastra Plateau. It is made by lava. It has shallow valleys of the Godavari, Bhima and Krishna. Telangana plateau and Karnataka plateau are extended in the south part of the peninsula and have rolling plains and deep valleys.

The Vindhyachal Mountain Range is a combination of Vindhyahal, Bharner, Kaimur and Parasnath Hills. It is known for red sandstone. It is an escarpment of Narmada valley. Satpura mountain range is a combination of Mahadev, Maikal and Rajmahal hills. Amarkantak peak of the range is known for Dhuandhar waterfall. Aravalli hills are the oldest mountains. Western Ghats are just like a wall of western edge of the Plateau. It is crossed by three passes. Eastern Ghats forming the eastern edge have been badly eroded by the rivers. These Ghats join Western Ghats through Nilgiri hills. Narmada and Tapi River valleys are rift valley and form estuaries.

The mainland coastal plain is 5686 kms. long. It is known as western coastal plain in the west. It is a quite narrow plain and has steep slope towards Arabian Sea. Eastern coastal plains are much wider and contain many prominent deltas. India has 247 distant islands. Out of which 222 islands are situated in Bay of Bengal and the remaining in Arabian Sea. Arabian Sea islands are coral islands. Bay of Bengal islands are remanants of tertiary folds. In Arabian Sea, Lakshdweep islands are a group of 25 islands. These distant islands are at a distance of 200 to 300 kms. from the western coast of India. Bay of Bengal islands are off shore and distant islands both. Andaman Islands are 203 in number. These have rugged topography with dense vegetation. Nicobar Islands are 19 in number. The Great Nicobar is the largest island. The south most point is known as Indira point, which is now washed away by Tsunami waves. These are covered with thick forests.

2.6 GLOSSARY

- Aggradational Plain - Depositional plain
- Angaraland - A landmass in the north of Tethys Sea
- Back water - Shallow lagoons
- Beel - Dead arms of rivers
- Bhangar - Old Alluvium
- Bhavar - A piedmont plain of unassorted debris
- Bhur - Dunes of sand
- Cope Comorin - Kanya Kumari
- Deccan Traps - Deccan Lava Plateau
- Distant islands - Situated nearly 5 km away from the main land
- Duns and Duars - Valleys between Shiwaliks and middle Himalayas longitudinal vales

- Escarpment - An elevated wall side of a hill
- Foredeep - A great depression or geosynclines
- Glacier - River of ice and snow
- Gondwana land - A landmass in the south of Tethys Sea
- Group of Rocks - Divided into systems of Rocks
- Himadri - Snow land
- Khadar - New Alluvium
- Kosi - Sorrow of river
- Lagoons - Circular or ring coral lakes
- Lesser Himalayas - Middle Himalayas main land
- Monotonous Plain - Uniform in topography of mainland
- Off shore islands - Situated near or along the coastal line of mainland
- Outer Himalayas - Shiwalik or sub-Himalayas
- Pass - A narrow gap between two hills
- Pre-Cambrian - Archean Rocks
- Rann of Kutch - Sandy and saline plain
- Reh - Saline land
- Rift valley - A submerged valley between two high Landmasses
- Rolling plain - A plain at certain height with considerable slope
- Sahyadri - Western Ghats
- Terai - Low lying plain
- Terrestrial plants - Glossopteris flora
- Vindhyan Stone - Red Sandstone
- Watershed - Water divide are between two Regular River Flow

2.7 ANSWER TO CHECK YOUR PROGRESS

1. The present relief is the product of long geological history.

2. Geological history of India is identical to human history.

3. India has geological formations from Precambrian to the Recent times.

4. Indian Rocks belong to four main groups – Archean, Purana, Dravidian and Aryan.

5. Archean Rocks are the oldest rocks, and highly metamorphosed.

6. Archean rocks are of two systems- Archean and Dhawar.

7. Dharwar Rocks are rich in minerals like iron ore, manganese, mica.

8. Aravalli hills were formed in Dharwar period.

9. Purana group of rocks is composed by cuddapah and Vindhyan System

10. Cuddpah Rocks are less significant than Vindhyan Rocks.

11. Vindhyan Rocks are known for excellent and durable limestone and Red sandstone.

12. Dravidian Rocks are mainly found in extra-peninsular region.

13. Aryan system of rocks belong Upper Carboniferous to recent times.

14. Gondwana Rocks of river valleys are rich in coal reserves.

15. The weathering of Deccan Trap rocks has given birth to black cotton soil.

16. Eocene to Pliocene period is known for tertiary system of rocks.

17. Tertiary system of Rocks gave us two physiographic regions Himalayas and Great Plains.

18. The orogenic movements on the Tethys Sea basins gave birth to Himalayas.

19. Pleistocene Rocks are marked by cold climate and glaciations.

20. Karewa Sarovar Rocks of Kashmir gave the birth to Kashmir valley.

21. Indo-Gangetic Alluvium deposits are brought by Indus, Sutlej, Ganga and Brahmaputra Rivers.

22. The coastal areas of peninsular India have alluvial deposits of Pleistocene age.

23. Peninsular India has rocks of oldest period to recent period.

24. Himalayas and Great Plains have rocks of tertiary to recent age.

25. Indian physiography is complex due to long geological history.

26. To determine the number of physical divisions of India, it is a difficult task due to geomorphological diversities.

27. India may be put into five physiographic divisions on the basis of nature of surface.

28. The Himalayas of India are well defined and are extended between the gorges of Indus and Brahmaputra.

29. Himalayas are young folded mountains.

30. Himalayas are still in the stage of formation.

31. Great Himalayas are the loftiest and continuous rangers.

32. It is snow bound throughout the year.

33. Middle Himalayas are also known as lesser Himalayas.

34. Banihal pass connects Jammu with Srinagar.

35. Kashmir valley is extended between Pir-Panjal and Great Himalayas.

36. Kashmir valley was a lake in the Pleistocene age.

37. Outer Himalayas are known as Siwaliks.

38. Siwaliks are composed of sands, gravels and conglomerates.

39. Valleys scattered between Siwaliks and middle Himalayas are known as Duns and Duars.

40. Trans-Himalayas are extended immediately north of Great Himalayas.

41. Trans-Himalayas include Zaskar, Kailash, Laddakh and Karakoram.

42. Kara-Koram Range is a region of lofty peaks and vast glaciers.

43. The highest peak of Kara-Koram Range is MT. K2 (8611m)

44. Siachin glacier of Nubra valley is the longest glacier of the Kara-Koram area.

45. Eastern hills are known as Patkoi, Naga and Manipurm hills.

46. The great plains are aggradational plains.

47. The Great Plains is a result of great depositions of a deep depression.

48. To division of Great Plains is quite typical due to its monotony in nature.

49. The plain is marked by Bhavar on its north as a piedmont plain.

50. Terai Region is a low lying plain, with finer sediments.

51. Bhangar and Khadar are the main alluviums.

52. The western extremity of the Great Plains is known as Rajasthan plain.

53. Punjab Haryana plain is also known as Sutlej-Yamuna Divide.

54. Ganga plains have three sub-divisions upper, middle and lower.

55. Peninsular plateau is the combination of a number of small plateaus hills ranges, inspersed with river basins and valleys.

56. Malwa plateau is formed of lava and covered with black soils.

57. North-east part of Malwa plateau is known as Bundelkhand and Baghelkhand plateau.

58. Chhota Nagpur plateau is the store-house of minerals.

59. Deccan plateau is underlain by basaltic rocks of lava origin.

60. Vindhyachal Mountain range runs parallel to Narmada valley.

61. Vindhyahal mountain range is an escarpment of Narmada Rift valley.

62. Satpura mountain runs in east-west direction between Narmada and Tapi.

63. Satpura mountain Range is a combination of Satpura, Mahadev, Maikal and Rajmahal Hills.

64. Vindhyachal mountain Range is known as Vindhyachal, Bharner, Kaimur and Parasnath Hills.

65. Aravalli Hills are the oldest folded mountains.

66. The highest peak of Aravalli Hills is Gurusikhar Peak with 1722 mts height on Abu Hills.

67. Western Ghats run parallel and close to Arabian Sea coast.

68. Western ghats have three main passes-Thalghat, Bhorghat and Palghat.

69. Eastern ghats have been broken at many places by the rivers.

70. Eastern ghats join western ghats near Nilgiri Hills.

71. Narmada and Tapi Rivers form their estuaries and flow in rift valley.

72. Peninsular India conclusively has a great variety of physical features.

73. The length of our total coast line (with islands) is 7515 km.

74. Western coastal plains are narrow coastal plain.

75. Konkan and Malabar coastal plains are main part of western coastal plains.

76. Eastern coastal plains are much wider and contain prominent deltas.

77. Eastern coastal plain is also known as North circar coast and coromandal coast.

78. India has 247 distant islands.

79. Arabian Sea islands are the remnants of old landmass.

80. Bay of Bengal Islands represent surfaces of the tertiary fold axis.

81. The distant islands of Arabian Sea are known as Lakshadweep Islands.

82. Bay of Bengal Islands as distant islands are defined as Andaman and Nicobar islands.

83. Pam-ban Island, an off-shore island connects India with Srilanka.

84. Sri Hari kota Island is a centre of ISRO and is situated near Nellore of Andhra Pradesh.

2.8 REFERENCES

1. Bansal, S.C. (2014): Bharat Ka Vrahad Bhugola, Meenakshi Prakashan, Meerut.

2. Chatterjee, S.P. (1999) India : A physical geography, publication division, Government of India, New Delhi.

3. Gautam, Alka (2006): Advanced geography of India, Sharda Pustak Bhandar Allahabad.

4. Khullar, D.R. (2006): India: A Comprehensive Geography, Kalyani Publishers Ludhiana.

5. Singh, R.L. (ed) (1971) India: A regional Geography, National Geographical Society of India, Varanasi.

2.9 TERMINAL QUESTIONS

(A) LONG QUESTION

1. Geological History of India is full of diversities. Examine this statement.

2. Archean group of rocks are basic rocks of India. Explain it in the context of their distribution.

3. Gondwana Rocks are known for their economic importance. Explain the distribution of these rocks.

4. Examine the geological structure of Peninsular India.

5. Tertiary Rocks have played a great role in the make of present map of India. How much do you agree with this statement? Explain.

6. Explain in detail the relief surface of Himalayan Mountain Region.

7. Elaborate the orogeny of Himalayas.

8. Give a geographical classification of Himalayas.

9. The Great Plains of India is a contribution of Himalayan Rivers. Justify this statement.

10. Explain the surface features of Indian Great Plains.

11. Discuss the physical characteristics of Gangetic Plain.

12. Discuss the social and economic importance of the Great Plains of India.

(B) SHORT QUESTIONS

1. Divide India into physiographic regions and explain the physical features of any one of the Region.

2. India Plateau is an association of a number of plateaus, river valleys and hills. Examine this statement.

3. Write an essay on the relief of Southern Peninsula.

4. Discuss in detail main plateaus of peninsular India.

5. Discuss in detail main hills and mountains of peninsular India.

6. Western coastal plains and East coastal plains are not identical. Examine this statement in reference of their surface variations.

7. East coastal plains are broad coast plains. Discuss.

8. Describe the geographical structure of Western Coastal Plain.

9. Write an essay on the physical structure of Indian islands.

10. Peninsular India has a great variety of physical features. How do you agree with this statement? Examine it.

(C) MULTIPLE CHOICE QUESTIONS

1. Which is not included in Archean Rocks-
(a) Gneiss (b) Schist (c) Granite (d) Sedimentary
2. Which mineral is not found in Cuddapah Rocks-
(a) Iron ore (b) Manganese(c) Coal (d) Copper
3. Vindhyan Rocks are not found in which state-
(a) Meghalaya (b) Karnataka (c) Madhya Pradesh (d) Rajasthan
4. Gondwana Rocks are found in which River valley-
(a) Ganga (b) Mahanadi (c) Sutlej (d) Brahmputra
5. Which rocks are important for coal-
(a) Gondwana (b) Vindhyan (c) Deccan Trap (d) Cuddapah
6. Which has the main contribution in the formation of Deccan Traps-
(a) Granite (b) Lava (c) Clay soil (d) Sedimentary rock
7. Tertiary Rocks have helped in the formation of which physiographic region-
(a) Himalayas (b) Great Plains (c) Chhota Nagpur Plateau (d) Aravalli Hills
8. Which pass provide way to Srinagar-
(a) Banihal (b) Pir Panjal (c) Zipla (d) Rohtang
9. Indus River forms deep George at which depth near Nanga Parbat-
(a) 5280mTS (b) 5100mTS (c) 5180Mts (d)5150mTS
10. Which glacier is the longest one of Trans-Himalaya-
(a) Baltora (b) Siyachin (c) Wichafo (d) Hisspar
11. K2 mountain peak is situated on which mountain range-
(a) Zaskar (b) Laddakh (c) Kara-Koram (d) Hindukush
12. Sutlej-Yamuna Divide is not extended on which state-
(a)Punjab (b) Haryana (c) Delhi (d) Himachal Pradesh
13. Which part of Great Plains has least slope gradient-?
(a) Upper (b) Middle (c) Lower (d) not any one
14. Alluvial deposits have taken place on the bed of which rocks-
(a) Tertiary (b) Godwana(c) Archean (d) Vindhyan
15. Which lake is the biggest one-
(a) Sambhar (b) Didwana (c) Kuchaman (d) Degna

16. Which hills are the oldest-
(a) Vindhyachal (b) Satpura (c) Aravalli (d) Garo
17. Which river divides peninsular India into two divisions-
(a) Chambal (b) Narmada (c) Tapi (d) Damodar
18. Oatacmond (ooty) is situated on which hills-
(a) Palni (b) Nallamalai (c) Nilgiri (d) Rajmahal
19. Western and Eastern ghats meet at which place-
(a) Annamalai (b) Palni (c) Nilgiri (d) Aravalli
20. Which is the highest peak of peninsular India-
(a) Dodabeta (b) Annaimudi (c) Gurushikhar (d) Dhupgarh
21. Which river does not form its own delta-
(a) Mahanadi (b) Godavari (c) Kaveri (d) Narmada
22. Dhuaondhar waterfall is situated on which river-
(a) Tapi (b) Narmada (c) Sabarmati (d) Mahanadi
23. Rann of Kutch does not have which feature-
(a) Salty (b) Sandy (c) Infertile (d) Fertile
24. Mandvi-Zuari narrow valley is located in which state-
(a) Karnataka (b) Kerala (c) Goa (d) Maharashtra
25. India has how many Islands-
(a) 251 (b) 247 (c) 222 (d) 210
26. Which island is not located in Arabian Sea-
(a) Laccadiv (b) Minicoy (c) Amindivi (d) Pamvan
27. Which island is coral made-
(a) Laccadiv (b) Nicobar (c) North Andaman (d) Harikota

Answer

1 (d), 2 (c), 3 (a), 4 (b), 5 (a), 6 (b), 7 (a), 8 (a), 9 (c), 10 (b) , 11 (c), 12 (d), 13 (c), 14 (c), 15 (a), 16 (c), 17 (b), 18 (c), 19 (c), 20 (b), 21 (d), 22 (b), 23 (d), 24 (c), 25 (b), 26 (d), 27 (a)

UNIT 3 DRAINAGE SYSTEM OF INDIA

3.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Understand in detail about the drainage system of India.
- Know the major river basins of India.
- Know about the National Water Policy, National Water Grid and Interstate River Water Disputes.
- Get the information about lakes and waterfalls.

3.2 INTRODUCTION

The drainage system is the sequence of rivers flowing in an area. Under this, the flow order of big rivers and their tributaries are being studied. According to **W. D. Thornbury**, "Drainage pattern refers to the particular plan or design, which the individual stream course collectively forms." Rivers have contributed a lot in the economic development of India. Since time immemorial, rivers have been living here as a means of economic and social activities of human beings. The Aryans who came from the west had also made the Indus and Ganga rivers their abode. Mohanjodaro, Harappa, Aryan civilizations were also born in these river valleys. The rivers of India are not only used for drinking water but also for irrigation, internal trade, hydropower generation etc. The ancient cities of India developed on the banks of rivers, because they got the facility of rivers to do business. Most of India's religious cities, temples and commercial cities are located on river banks. Even today, they have a special contribution in the prosperity of the country.

3.3 DRAINAGE SYSTEM OF INDIA

The drainage system of India can be divided into two major systems - (1) the drainage system of the Bay of Bengal and (2) the drainage system of the Arabian Sea. They are separated from each other by Delhi range (Sutlej-Yamuna water divide) Aravali, Sahyadri and Amarkantak. About 77% of the country's drainage area is oriented towards the Bay of Bengal, in which the rivers Ganga, Brahmaputra, Mahanadi, Godavari, Krishna, Kaveri, Vaigai etc. The area of the Arabian Sea drainage system (23 percent) is limited to the northwestern Himalayas,

Table-3.1: Details of major river basins of India.

Sl. No	Basin Code	Basin Name	Area (km^2)
1	1	Indus (Up to border) Basin	453931.9
2	2a	Ganga Basin	808334.4
3	2b	Brahmaputra Basin	186421.6
4	2c	Barak and others Basin	45622.41
5	3	Godavari Basin	302063.9
6	4	Krishna Basin	254743.3
7	5	Cauvery Basin	85624.44
8	6	Subarnarekha Basin	25792.16
9	7	Brahmani and Baitarni Basin	51893.68
10	8	Mahanadi Basin	139659.2
11	9	Pennar Basin	54243.43
12	10	Mahi Basin	38336.8
13	11	Sabarmati Basin	30678.59
14	12	Narmada Basin	92670.51
15	13	Tapi Basin	63922.91
16	14	West flowing rivers South of Tapi Basin	111643.9
17	15	East flowing rivers between Mahanadi and Godavari Basin	46243.06
18	16	East flowing rivers between Godavari and Krishna Basin	10345.16
19	17	East flowing rivers between Krishna and Pennar Basin	23335.82
20	18	East flowing rivers between Pennar and Cauvery Basin	63646.21
21	19	East flowing rivers South of Cauvery Basin	38646.11
22	20	West flowing rivers of Kutch and Saurashtra including Luni Basin	184441.1
23	21	Minor rivers draining into Bangladesh Basin	5453.23
24	22	Minor rivers draining into Myanmar Basin	24731.08
25	23	Area of North Ladakh not draining into Indus Basin	29238.78
26	24	Drainage Area of Andaman and Nicobar Islands Basin	6918.2
27	25	Drainage Area of Lakshadweep Islands Basin	462.59
28		Island Basin	371.4

the Punjab plain, Rajasthan, Gujarat, the intermediate plateau and the western coastal plain, which includes Indus, Narmada, Tapi, Luni, Mahi and the rivers originating from Sahyadri. On the basis of origin, Indian drainage can be named as Himalayan drainage and Peninsular drainage. A third method divides it into North Indian and South Indian drainage system under regional distribution. Similarly, the Himalaya-Karakoram, Vindhya-Satapura and Sahyadri watersheds are the source of all major rivers of the country.

The drainage basin is the area that is drained by a river and its tributaries. It means when a catchment area collects water from a river, that catchment area is called a Drainage Basin. On the basis of drainage area/catchment area, the drainage area is divided into three parts-

(1) Major River Basin

The river basin whose drainage area is more than 20,000 sq. kms is called a major river basin. Fourteen river basins of India are included in this. This is about 84 percent of the drainage area of the whole of India. It includes the basins of the Indus, Ganga, Brahmaputra, Sabarmati, Mahi, Narmada, Tapti, Subarnarekha, Brahmani, Mahanadi, Godavari, Krishna, Pennar and Kaveri rivers.

(2) Middle River Basin

Under this, those river basins are included, whose drainage area is between 2,000 to 20,000 sq. kms,. It includes basins of 44 rivers. Under this, rivers are divided into 3 parts, (a) those which flow towards the west, such as- Satrunji, Bhadra, Budhabalang, Vaitarna, Purna, Ambika, Ulhas, Savitri, Mandwa, Gangavati, Kali Nadi, Sharavati, Netravati, Galiyar, Bharatpuja, Periyar and Pamba. (b) The rivers that flow towards the east are Rasikulia, Vamasdhara, Nagavali, Sharda, Yaleru, Musi, Paleru, Muneru, Kunleru, Kartaliar, Palar, Gingee, Paniyar, Velar, Vaigai, Kudar, Varsali, Vaiyar and Tamraparni. Rivers flow into other countries, such as Karnaphuli, Kaldan, Imphal and Tiksu Nanitaluk. These account 8% of the annual flow.

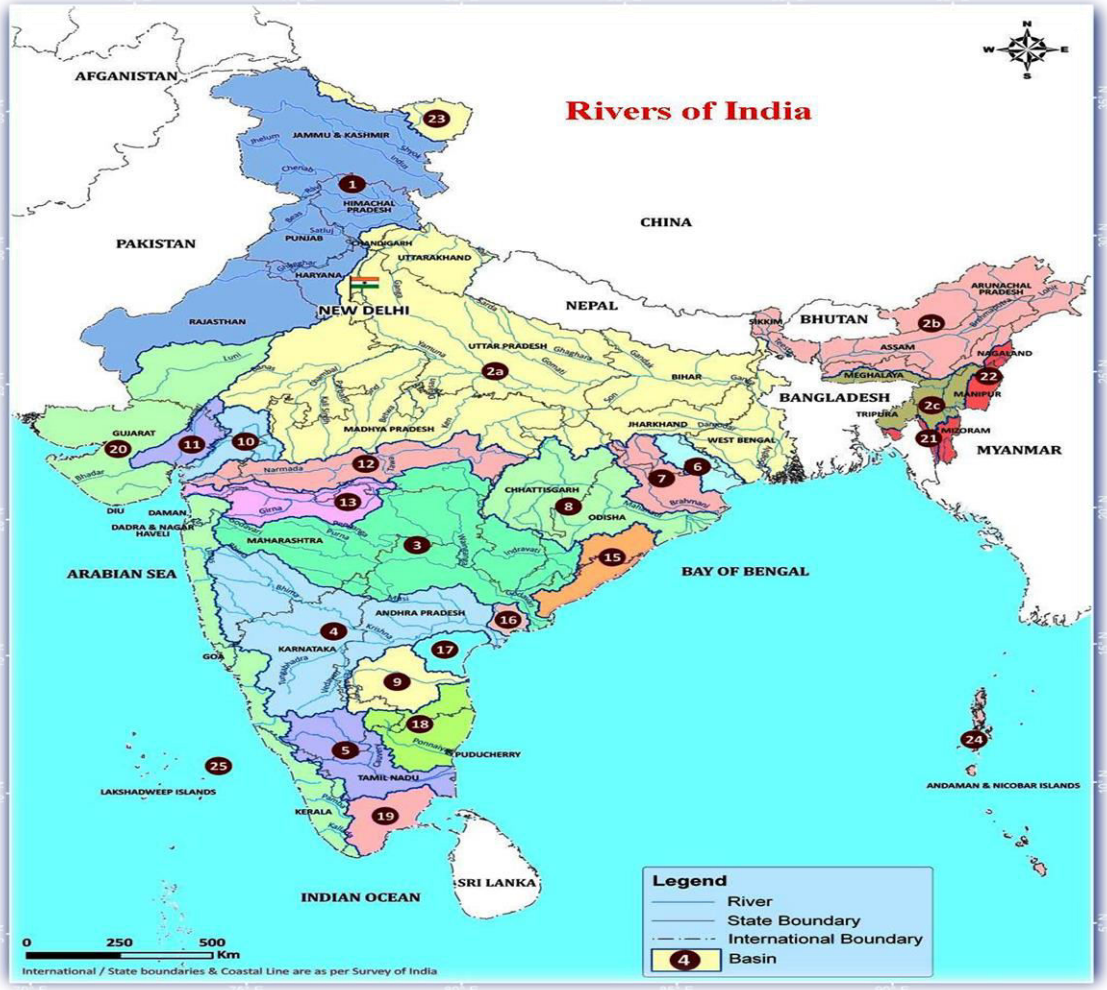
(3) Small River Basin

In this, those river basins are included; whose drainage area is less than 2,000 sq. kms. Many small rivers are included under this category. The small rivers flowing in the area of less rainfall

and the rivers coming out of the Western Ghats and falling into the Arabian Sea are prominent. The annual water availability is 8%.

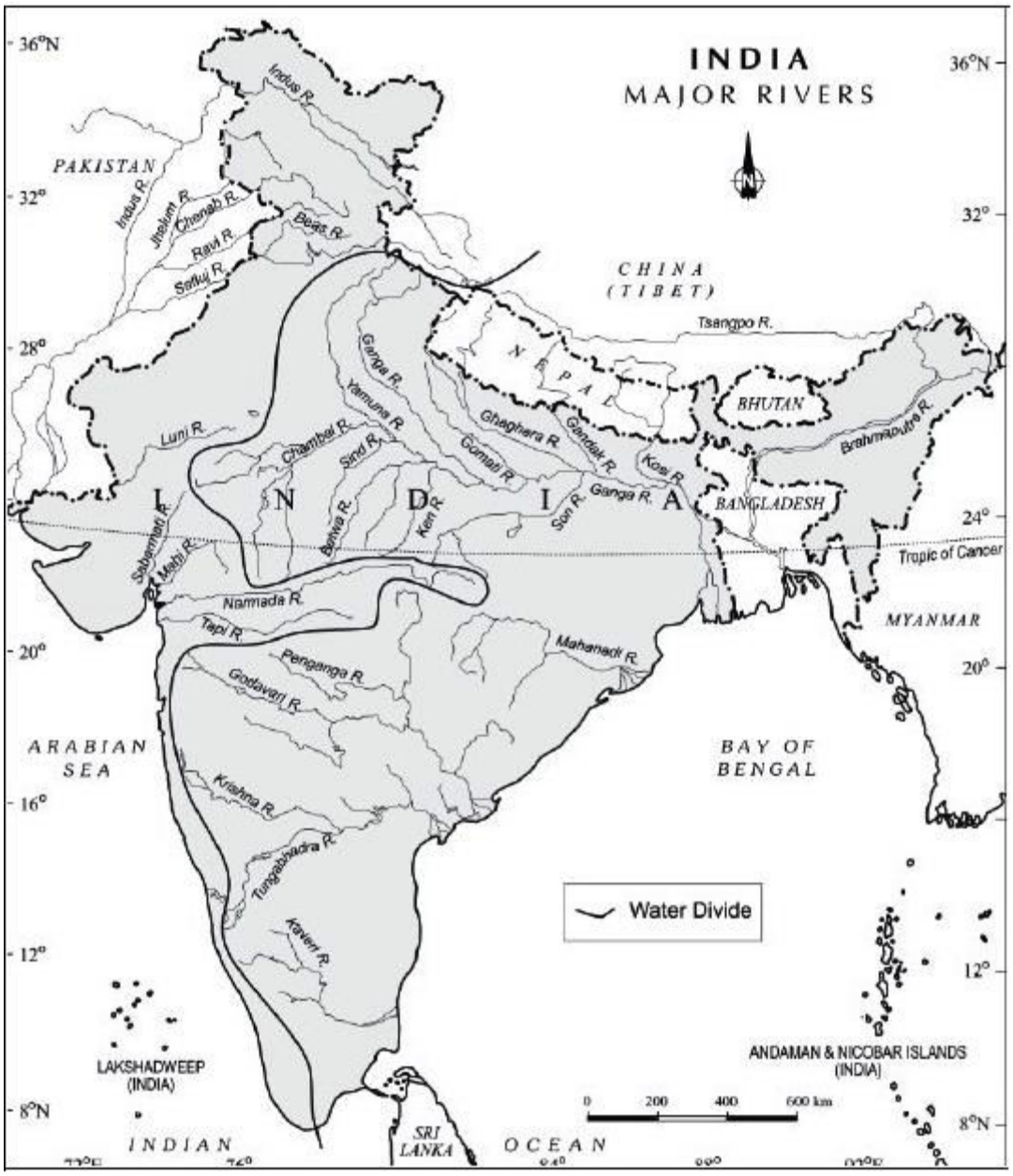
According to India – Water Resources Information System (WRIS), using the SRTM DEM data of NASA, having a spatial resolution of 90 meters, the basin and sub-basin boundaries for the Indian subcontinent have been delineated. As per this information, the country has been divided into 25 Major River Basins and 103 sub-basins. The names of the basins are given in the attached Table-3.1:

Fig. 3.1: Presentation of major river basins of India.



Source: *Google Imagery*

Fig 3.2: Major river of India.



Source: Google Imagery

Himalayan Drainage System

The Himalayan drainage system mainly includes the Ganga, Indus and Brahmaputra river basins. The rivers are perennial because they depend on both snow melt and precipitation. These rivers pass through deep gorges, which are formed by the process of erosion along with

the upliftment of Himalayas. In addition to great gorges, these rivers also make V-shaped valleys, islets and waterfalls in their mountainous course. When these rivers enter the plains, they form depositional topographies such as flat valleys, oxbow lakes, floodplains, braided channels and deltas at river mouths. The course of these rivers is crooked, due to which they keep changing their course. There are antecedent rivers like Indus, Brahmaputra, Sutlej, Alaknanda, Karnali, Gandak, Kosi etc., which flowed before the emergence of the Himalayas. Water of these is used for drinking, irrigation, transportation, power generation, tourism development and industrial works. Transportation is difficult due to lack of water in the dry season.

Evolution

E. H. Pascoe (1919) and G. E. Pilgrim (1919) have explained the origin of Himalayan drainage. According to him, a Tibetan river used to flow in the plateau region of Tibet from east to west, which was made up of the present Sampo, Indus and Oxus rivers. Similarly, the other big river Indo Brahma (Pascoe, 1919) or Shivalik (Pilgrim, 1919) flowing from east to west in the south of the Himalayas used to fall into the Gulf of Indus. Of these, the Tibetan river was fragmented by head erosion of left side tributaries like Proto-Indus, Proto-Sutlej and Proto-Brahmaputra etc. and was acquired by the current Irrawaddy-Chhindwin and lower currents of the rivers of Brahmaputra, Sutlej and Indus. Similarly, the Shivalik river also got divided into three parts during the Pleistocene period due to the upliftment of the Potwar Plateau (Delhi Ridge) and the deposition of the Malda Gap (the region between the Rajmahal Hills and the Meghalaya Plateau). The western part of the river developed into the Indus River and started flowing towards the Arabian Sea. The intermediate part flowing in the opposite direction started falling into the Bay of Bengal after being affected in the form of river Ganga. The rest of the eastern part starts getting affected like the Bay of Bengal in the form of the Brahmaputra river with the help of the old route. Initially, the Yamuna was a tributary of the Indus, flowing towards the south-west, but later on, following the southern route, the Ganges included it in its order.

Changes in the course of River

Diversion and river capture are the main features of this drainage area. Top erosion in hilly areas is a major contributor to river capture. The story of mythical Saraswati is related to river capturing and diversion. About 2000-3000 years ago, it used to descend under the

Himalayas and flow near Churu. It was a tributary of the Luni. Later its course shifted towards the west and it joined the Sutlej near Ahmedpur. Later, a tributary of the Ganga kidnapped the water of its upper valley by top erosion and its lower part became dry which exists today as Ghaggar valley in Rajasthan. The river formed by river capturing was called Yamuna. In the third century BC, the Indus river used to flow 130 kilometers east of its present course and fall in the Rann of Kutch. Gradually, moving from the west, during the reign of Akbar, Chenab and Jhelum used to meet near Uch, but their present confluence is located near Mithankot, about 160 kms south-west. Multan was earlier situated on the banks of Ravi but today it is situated 60 kms south of the confluence of Chenab. About 250 years ago river Vyas left its old course and joined Sutlej near Sultanpur. In the early period of the Christian era, most of the rivers used to flow independently from the east and fall into the Arabian Sea.

There are many examples of channel change in the rivers of Bengal and Assam. Gaur, the capital of the kings of the Pala dynasty, was earlier a prosperous city on the banks of the Ganges, which became deserted after the Ganges shifted to the west. The Teesta River of northern Bengal used to flow through the valley of Purnabhaba in the Barind region and join the Ganges near Jaffar, in the flood of 1787 AD it joined the Brahmaputra flowing through a new route. Between 1720-1830, due to the upliftment of the Madhupur forest area, the Brahmaputra straightened its course and joined the Ganges, known as the Jamuna. Even today its weak stream flows on its old path and is known as Brahmaputra.

Sindhu River System

The system consists of the Indus River and its five main tributaries—the Jhelum, the Chenab, the Ravi, the Beas, and the Sutlej. The water of the western Himalayan region flows into the Arabian Sea through the rivers of this sequence.

Indus - The Indus originates from a glacier near Bokhar Chu 31°15′ north latitude and 81°40′ east longitude in the Tibetan region at an altitude of 4164 meters in the Kailash mountain range. In Tibet it is known as 'Singi Khamban' or Lion's Mouth. It flows west and north-west and enters the Indian territory of Ladakh. The river pierces the Kailash range several times, forming a spectacular gorge in this reach. It flows through Baltistan and Gilgit. The Indus receives a large number of Himalayan tributaries on both its right and left banks. The main tributaries are Shyok,

Gilgit, Zaskar, Hunza, Nubra, Shigar, Gasting and Drass. It finally rises in the hills of Attock, where it receives the Kabul River on its right bank. Other important tributaries joining the right bank are Khurram, Tochi, Gomal, Viboa and Sangar. All these tributaries originate from the Suleman range. The river flows south and receives the Panjnad a little above Mithankot. Panjnad is the name given to the Jhelum, Chenab, Ravi, Beas and Sutlej rivers of Punjab. It finally empties into the Arabian Sea east of Karachi. The Indus flows only through Ladakh and Jammu and Kashmir in India. With a total length of 2,880 kms, the Indus is considered one of the largest rivers in the world. Its length in India is 709 kms. Its catchment area is 1,165,000 kms², of which only 321,290 kms² is within India. India can use a total of 4,195 million cubic meters (only 20 per cent) of its total discharge under the rules of the Indus Water Treaty signed with Pakistan.

Jhelum- It originates from a spring at Verinag situated in the south-eastern part of the valley of Kashmir. It flows north from its source to the Wular Lake and further south-west until it enters the gorge cut by the river in the Pir Panjal range. It turns north-west below Uri and south below Muzaffarabad and continues till Mangla. Between Muzaffarabad and Mangla, it runs roughly along the India-Pakistan border. It joins the Chenab near Jhang in Pakistan. Out of the total drainage area of this basin, 28,490 sq kms is located in India.

Chenab- Chenab in the state of Jammu and Kashmir is known as Chandrabhaga in Himachal Pradesh because it is formed by two streams, Chandra and Bhaga which join at Tandi near Keylong. The Chandrabagha flows towards the north-west and runs parallel to the Pir Panjal range for some distance. Near Kishtwar, it cuts a deep gorge in the Pir Panjal range and turns south and flows in this direction for a short distance. Further down, it turns west and enters the plains near Akhnoor. Its total length is 1180 kms. It flows through an area of 26,755 square kilometers in India.

Ravi- The origin of this river is located near the Rohtang Pass in the Kullu hills of Himachal Pradesh. It flows north-west from its origin and drains the area between the south-eastern part of the Pir Panjal range and the Dhauladhar range. Some distance from Chamba, it turns southwest, cuts a gorge in the Dhauladhar range and enters the Punjab plain near Madhopur. As it is part of the India-Pakistan border, the river has some strategic importance. It joins the Chenab near

Multan in Pakistan. Its total length is 725 kilometers and its drainage area is 5,957 square kilometers.

Beas - Its origin is known as Beas Kund, which is at an altitude of 4000 meters near Rohtang Pass. In its initial phase, it runs north to south between Manali and Kullu, where the valley is popularly known as the Kullu Valley. It crosses the Dhauladhar range through a deep gorge. Further down, it turns west and enters the Punjab plain near Talwara. After entering the plain, it turns southwest and joins the Sutlej near Harike, flowing a distance of 470 kms. It flows over a total area of 25,900 square kilometers.

Sutlej- It originates from Rakas Lake, which is situated at an altitude of 4555 meters in Tibet. This lake is connected to Lake Mansarovar by a stream. It runs north-west and enters Himachal Pradesh through the Shipki La Pass. Further down, it flows west. It cuts deep gorges where it pierces the Himalayan range. Before entering the Punjab plains, it cuts a deep gorge where the Bhakra Dam has been constructed. Below Rupnagar (Rupar) it turns towards the west. The Beas, its right bank tributary, joins it at Harike. Its total length is 1050 kms. It flows through an area of 24,087 square kilometers in India. It is a very important river as it feeds the Bhakra Nangal Project, the Sirhind Canal System and the Indira Gandhi Canal System which originates from Harike.

Ganga River System

This river system includes the Ganges and its tributaries such as the Yamuna, the Gomti, the Ghaghra, the Gandak, the Ramganga, the Mahaganga and the Kosi. All these rivers originate from the Himalayas and are perennial. The expansion of the Ganges river system is found in about a quarter of the country's area. This creates a fertile plain, which is India's granary and most populated area. Important cities are located along the banks of the river and river water is used for irrigation, hydropower generation, industrial and drinking purposes. Ganga is the most important river of India in terms of cultural importance.

The Ganga originates from the Gangotri glacier near Gomukh situated at an altitude of 3900 meters in Uttarkashi district of Uttarakhand, here it is called Bhagirathi. Bhagirathi meets Alaknanda at Devprayag, after which both are known as Ganga. Alaknanda is a big river, whose

main branches are Dhauli and Vishnu Ganga, which meet at Vishnuprayag. The source of the Alaknanda is in the Satopanth Glacier above Badrinath. Flowing west-south-west, the Ganges rises in the hills near Haridwar. The total length of the Ganges is 2,525 kms. It is shared by Uttarakhand (110 kms) and Uttar Pradesh (1450 kms), Bihar (445 kms) and West Bengal (520 kms). The total area of the Ganges basin in India alone is 9,52,000 square kilometers. Beyond Farakka, it flows east-southeast into Bangladesh, where it divides itself into two distributaries, the Bhagirathi-Hooghly and the Padma. The Padma receives the Brahmaputra, which is known here as the Jamuna and the Meghna, before falling into the Bay of Bengal. The Ganges is the main river of India, in which many tributaries come from the Himalayas in the north. Ramganga, Gomti, Tons, Ghaghra, Gandak, Bagmati and Kosi are the major tributaries that meet on the left bank. All of these are perennial and originate from the Himalayas. Yamuna, Son, Punpun, Damodar and Rupnarayan are the rivers that meet on the right bank.

Yamuna- It is a right bank tributary of the Ganges and takes its rise in the Yamunotri Glacier at an altitude of 6316 meters on the Bandarpoonch range. After cutting a deep gorge in the Lesser Himalayas, it flows southwest and enters the Gangetic plain near Tajewala. It flows south till Agra and further south-east to join the Ganga at Allahabad. The length of the Yamuna from its source to Allahabad is approximately 1,375 kms. The total basin area of the Yamuna is 3,66,223 square kilometers which is shared by Uttarakhand, Uttar Pradesh and Delhi. It is joined by Chambal, Sindh, Betwa and Ken on its right bank which originates from the peninsular plateau. While the Hindon, Rind, Sengar, Naan, Sasurkhaderi, Varuna etc. join it on its left bank. Tons, Giri and Asan rivers join it in the mountainous region. It was the main means of transport in the Middle Ages. Today, most of its water is used for irrigation by taking it out through the western and eastern Yamuna and Agra canals.

Chambal- The Chambal rises near Mhow in the Malwa plateau of Madhya Pradesh and flows generally northwards in a gorge up to Kota. Below Kota it turns in a north-east direction and reaches Pinahat and turns east and runs almost parallel to the Yamuna before joining the Yamuna in the southern part of Etawah district in Uttar Pradesh. It is 960 kms long. It's important tributaries are the Banas on the left bank and the Kali Sindh on the right bank. Chambal is notorious for its bad land topography called Bihad. Gandhi Sagar Dam has been built on it near Kota.

Betwa- Betwa river originates from the southwest of Bhopal and flows through Vidisha, Lalitpur, Jhansi, Jalaun and Hamirpur districts and meets Yamuna near Hamirpur. Its total length is 480 kilometers. Historical cities like Sanchi, Vidisha etc. are situated on its banks.

Ramganga- It is a comparatively small river, which originates in the southern part of the main Himalayan range, near Dwarahat in Almora district. After its 144 kilometer course of mountain influence, it enters the Gangetic plain near Kalagarh and flows out near Kannauj and meets the Ganges. This river is 600 kilometers long and its drainage area is spread over an area of 32,800 square kilometers.

Kali, Kaliganga or Sharada- The Kali River originates from the Milam Glacier in the north-eastern part of Kumaon. Its two tributaries are Dharya and Lisar, which flow from the south-east direction in their upper parts, but in the main river, Saryu and East Ramganga rivers come from the north-west and meet near Pancheshwar. From here, going round the hills in the name of Sharda, it enters the ground near Brahmadev. Beyond this, this river forms the border between Nepal and Pilibhit district of Uttar Pradesh. There are 4 branches of this river in Kheri. The Sharda river joins the Ghaghra near Baharamghat making a detour. Sharda canal has been taken out from this near Brahmadev. Its total length is 350 kms.

Ghaghra (Karnali or Kauriala) - The Ghaghra originates from the Mapcha Chungo glacier in the north-west of Takla Kot. It is of trans-Himalayan origin and crosses the western part of the Nepal Himalayas through deep and narrow gorges. Its important tributaries are Sarada, Sarayu (on whose banks Ayodhya is situated), Chhoti Gandak and Rapti. The Ghaghra joins the Ganges a few kilometers below Chhapra in Bihar after traveling 1080 kilometers from its source.

Gandak- The Gandak (Sadanira, Saligrami in Nepal or Narayani in the plains) is made up of rivers named Kali Gandak and Trishulganga. Nepal receives a large number of tributaries in the Himalayas, the most prominent of which are the Kali Gandak, the Mayangadi, the Bari and the Trishuli. After entering Bihar's Champaran district, it turns southeast and joins the left bank of the Ganges at Sonpur. Like the Ghaghra, it changes its course frequently and is notorious for its floods. Its total length is 425 kilometers and the drainage area is 48,500 square kilometers.

Kosi or Kausika- It is the largest tributary of the Ganges. It is made up of seven rivers, in which the Arun (Fungchu in Tibet) is the main one, which originates from the north of Gausainath. After crossing the middle Himalayas in Nepal, it is joined by the Son Kosi from the west and the Taimur Kosi from the east. It along with the Arun River forms the Sapta Kosi. It drains eastern Nepal and enters Saharsa district of Bihar in several channels. The river is notorious for changing course, depositing silt and causing floods. It is often called the "Sorrow of Bihar". Despite several river protection measures, it still causes major floods practically every year. It joins the left bank of the Ganges at Karagola. The total length of the river is 730 kilometers and the drainage area is 86,900 square kilometers.

Sone or Swarnanadi- The Son is a major south bank tributary of the Ganges, which originates from the Amarkantak plateau. After making a chain of springs on the edge of the plateau, it reaches Ara in the west of Patna and joins the Ganges. It is 780 kms long. It joins the Ganges while forming many falls in Vindhya ranges and collecting water from Banas, Gopad, Rihand, Kanhar and North Koel rivers. Its valley is 4.8 kilometers wider in the plain of Bihar. In the rainy season, it takes a formidable form. About 1000 years ago, it used to meet the Ganges near Patna, but its confluence is continuously going from the west.

Damodar- The Damodar River originates from the Chota Nagpur Plateau (1366 m). It is also called 'Sorrow of Bengal'. It flows through a rift valley. Barakar, Jamunia, Barki etc. are its tributaries. At the end, collecting the water of the Rupnarayan river, it joins the Hooghly. Its total length is 541 kilometers and the drainage area is 22,000 square kilometers. Under the Damodar Valley Corporation, the water of this river is being used for the economic development of the area.

Brahmaputra River System.

The Brahmaputra river system is another major river system of the country. The Brahmaputra river is called the daughter of Brahma. The source of this river is in the Chemayung-dung glacier near Lake Mansarovar in Tibet. Here it flows eastwards for 1100 kms in a longitudinal valley called Sampu, parallel to the great Himalayan range. Tsangpo means 'purifier' in Tibetan. The Ragonsangpo is its main tributary in this area, which joins it on its right. It is the longest river originating from the Himalayan region. Its length is 2,580 kms. Its length

in India is 1,346 kms. Its expansion is spread over a total area of 5,80,000 square kilometers, of which 2,58,008 square kilometers is located in India. This river enters India by the name of Shiang or Dihang, cutting the middle Himalayas near Namcha Barwa (7756 m) mountain peak, forming a great gorge. The river enters India west of Sadiya town in the state of Arunachal Pradesh. From here the river flows towards the southwest. Where its tributaries Dibang and Lohit join it on its left bank. After this this river is known as Brahmaputra. After traveling 725 kilometers of the Assam Valley, the Brahmaputra has Subanshri, Bhadri, Kameng, Dhanshree, Dharala, Jaibhorli, Manas, Sankosh and Teesta from the north and Budhi Dihing, Dhanshree (south), Disang, Dikho, Janjhi, Kulsi, Jinjiram, and Kopili river coming from the south join it. This river brings extreme floods in this area. Along with this, it keeps on changing its routes as well. It is known for its bank erosion in the plains. Majuli, the largest river island in the region, is situated in the Brahmaputra River itself.

After Dhubri in Assam, it turns south and enters Bangladesh. Here Teesta river joins on its right side. After this it is called by the name of Jamuna river in Bangladesh. Flowing in the south, the Jamuna meets the Padma (Ganga) near Gwalandon. One of its streams turns towards the south-east and meets the Meghna river. Finally, both the Padma and Jamuna rivers join it near Chandpur. These combined streams widen to form a very large estuary in which many islands are formed. It has been declared as National Waterway between Dhubri and Sadiya, whose length is 890 kms. In the monsoon season, the depth of water in the river increases up to 10 meters and width up to 8 meters. Very severe floods occur in this river, due to which the state of Assam has to suffer immense loss of people and money. It is also called 'Sorrow of Assam'. The major cities of Assam are Dhubri, Goalpara, Guwahati, Dibrugarh and Sadiya etc. situated on its banks. Its annual water availability is 6,27,000 million cubic metres. It has a capacity to generate 1248 million kilowatts of hydropower.

The Teesta River is the last major tributary that drains the Brahmaputra River on the right bank. It originates from Pahunari Glacier, Jemu Glacier, Cholamu Sarovar etc. in Sikkim at an altitude of 7068 meters. Its length is about 309 kms and the drainage area is 12,540 sq kms. Its tributaries are Rangpo, Lachun, Rangit, Dikchhu, Rani Khol etc. Rangit river is the main tributary of Teesta. It originates from West Sikkim and joins West Bengal at a place called

Triveni near Teesta Bazar. This river is known for many water sparrows. Because of which it is famous all over the world for water sports 'rafting'. Its length is 80 kms.

The Subansiri river is the largest tributary of the Brahmaputra river system. This river originates from the Himalayas of Tibet region and flows south and south-east to join the Brahmaputra in Lakhimpur district of Assam. It is known as Upper Subansiri in the northern part or hilly part of Arunachal Pradesh and Lower Subansiri in the lower plains. Its length is about 442 kms. This river flows between Miri Hills and Abor Hills.

The Manas River is an antecedent river, which originates from Tibet and flows in the south direction forming a great gorge in the Great Himalayas. It enters the Brahmaputra near Gopalpara from Tibet to Bhutan and then enters the plains of Assam. It is the largest river system of Bhutan. Its total length is 376 kms, out of which 272 kms flows in Bhutan and 104 kms in India.

The origin of the Lohit River is in the Jayal Chhu mountain range in the eastern part of Tibet. And it joins Dibang river in Arunachal Pradesh with Sishang or Dishang (The Brahmaputra is known as Sishang or Dishang in the mountainous region of Arunachal Pradesh). After this Sishang or Dishang river is known as Brahmaputra River. Its total length is 191 kms. The meaning of Lohit is 'blood'. The water of this river appears partly red because of the type of soil and rocks in its flow area. Lohit district of Arunachal Pradesh is named after this river.

Peninsular Drainage System

The network of rivers originating from the Indian peninsular plateau is called the peninsular drainage system. Many small and big rivers flow in it, in which Narmada, Tapti, Mahi, Banas, Luni and Sabarmati rivers fall into the Arabian Sea. Rest of the rivers flowing towards the south and east drain into the Bay of Bengal. Some rivers originate from the Aravalli and hilly parts of Madhya Pradesh and fall into the Rann of Kutch and the Gulf of Khambhat. The Brahmani, Subarnarekha, Mahanadi, Krishna, Godavari, Kaveri and Tamraparni flow eastwards into the Bay of Bengal and form a delta. The rivers emerging from the Western Ghats and falling into the Arabian Sea towards the west are young and small. Chambal, Sindh, southern Tons, Betwa, Ken, Son and Damodar are part of the Ganga river system flowing in the northern part of the peninsula. Most of these river systems originate from the Western Ghats. Most of

these river systems originate from the Western Ghats. The Western Ghats act as the main watershed for the peninsular drainage system. The rivers originating from its eastern slope fall into the Bay of Bengal. Wherein the rivers coming out of the western slope fall into the Arabian Sea. Many features are found in the rivers flowing in the southern plateau. Compared to northern India, the rivers here are smaller and less in number because there is less rainfall. That's why the amount of water in these rivers remains less in summer. The peninsular river system is older than the Himalayan river system. Most of the rivers here have reached maturity. Its valleys are found to be wider and shallower. Due to superimposition and regeneration, it forms waterfalls in many areas. These rivers are affected in their straight path and do not change their course again and again. It does not make meander on its route. The peninsular rivers are not suitable for watershed and irrigation.

Origin of the Peninsular Drainage System

Prior to the formation of the Himalayas, the Sahyadri-Aravalli was the major watershed in Gondwanaland and the Western Ghats influenced rivers on both the east and the west. In the Tertiary period the western edge of the peninsular plateau went down due to subsidence, disturbing the generally agreed plan of the river on either side of the original watershed. The uplift of the Himalayan Mountains caused subsidence in the northern part of the Peninsular Plateau, which led to the formation of rift valleys. Narmada and Tapti rivers are flowing in this rift valley. According to Wadia, during the upliftment of Himalayas, the peninsular part was inclined towards the east, due to which most of the drainage of the region was oriented towards the Bay of Bengal.

River Systems of Peninsular Drainage

The rivers of peninsular drainage system can be divided into two categories on the basis of water discharge – (1) rivers falling into the Arabian Sea, and (2) rivers falling into the Bay of Bengal.

1. Rivers falling into the Arabian Sea-

Mahi- It is the third major river of Gujarat after Narmada and Tapti. It originates from Mehd Lake in Amjhara at an altitude of 445 meters above sea level from the western part of

Vidhyachal. After 225 kms the hills of Bagar turn it towards the west and after 40 kms then the hills of Mewar turn it towards the south west. Flowing in this direction, it falls into the Gulf of Khambhat. After 161 kilometers from its origin, its width becomes 180 meters and the depth becomes 0.3 meters. The tide comes in it till Bay of Beda. The bed of the river is so low from the neighboring land that its water cannot be used for irrigation. In India, Mahi River flows through three states of Madhya Pradesh, Rajasthan and Gujarat respectively. The nicknames of Mahi river are Ganga of Vagad, Ganga of Kanthal, Golden Line of South Rajasthan, Ganga of tribals. The total length of Mahi river in India is 576 kms. The total length of Mahi river in Rajasthan is 171 kms. Its drainage area is 34,842 sq kms. Mahi River is the only river in India which crosses the Tropic of Cancer twice. Mahi Bajaj Sagar, Kadana Dam, Vanakbori Dam have been constructed on this river. Its major tributaries are Som, Jakham, Moran, Anas, Panam, Iru, Nori, Chap, and Bhadar etc.

Sabarmati- The origin of this river is from Dungarpur district of Rajasthan in the south of Aravalli Mountain. It flows in a narrow drainage basin. Whose area is 21,700 sq kms and its length is 416 kms. It flows 45 kms in Rajasthan and 371 kms in Gujarat. This river flows south from its source and joins the Gulf of Khambhat, the Arabian Sea. Its small tributaries meet on its right bank. The major tributaries of Sabarmati River are Mazam River, Hathmati River, Wakal River, Sei River, Vetrak River, Meshwa River etc. All these tributaries of Sabarmati river originate from Dungarpur and Udaipur districts. It is the third largest west flowing river. Ahmedabad is the largest city located on the banks of this river.

Luni- This river system is the largest river system of Rajasthan and Thar Desert. Its length is 495 kms and the drainage area is 37,363 sq kms. It originates in the western slope of Aravalli hill near Pushkar in Rajasthan as two streams Saraswati and Sagarmati, which join together near Govindgarh. After which it is known as Luni river. After this, this river flows in the west direction till Talwara. Jojadi is the only major river found on its right, after which its direction turns to the south. Where many rivers coming out of Aravalli join it on its left bank. In which Sukdi, Mithri, Lildi, Jawai, Sagi, Bandi and Khari are the main tributaries. This river system is a seasonal or ephemeral river system. Its water is salty at the bottom of Balotra and sweet at the top. Finally, it flows south and joins the 'Runn of Kutch' in Gujarat. The drainage area of Luni river is called Godwad region.

Narmada- This river originates from the hill of Amarkantak at an altitude of 1,057 meters. Flowing in the rift valley between the Vindhyachal and Satpura ranges, it falls into the Arabian Sea, forming an estuary, south of Bharuch. It is the largest river of peninsular India. In this, Hiran, Orisan, Barna and Kolar come from the north and Budhner, Banjar, Shar, Shakkar, Dudhi and Tawa come from the south. Its total length is 1,312 kilometers and the drainage area is 98,795 square kilometers, of which 87% is in Madhya Pradesh, 11. 5% is located in Gujarat and 1.5% in Maharashtra state. This river passes through marble rocks in the Rift Valley and forms many small and big waterfalls and islands. Dhuandhar (Bheda Ghat) near Jabalpur in Madhya Pradesh forms the waterfall. Due to flowing in a narrow valley, it lacks tributaries. The Orissan River is its largest tributary. Whose length is 300 kms. The Sardar Sarovar Dam and the huge statue of Sardar Vallabh Bhai Patel have been constructed on this river.

Tapti or Tapi- Tapti is the other major west flowing river. The river originates at an altitude of 762 meters near Multai Nagar, south of Mahadev hill in Betul district of Madhya Pradesh. Its length is 724 kms and the drainage area is 65,145 sq kms. It flows parallel to it from east to west south of the Satpura hills from its origin and joins the Arabian Sea forming an estuary near the city of Surat in Gujarat. Purna, Beghar, Girna, Bori and Panjhar are tributaries on the left bank of this river and Aner is the main tributary on the right bank. 79 percent of its drainage area is located in Maharashtra, 15 percent in Madhya Pradesh and 6 percent in Gujarat. Purna is its main tributary, which joins it near Bhusaval. Its lower 48 kms long part is navigable. Its water is being used by Kakrapara and Ukai projects. Surat city is situated at its mouth.

Sharavati River - The origin of this river is near a place called Ambutirtha in Shimoga district of Karnataka. It merges into the Arabian Sea covering a distance of 128 kms from its origin. Its drainage area is 2,029 km². This river flows completely in Karnataka, most of which is in the Western Ghats. India's highest water fall Jog or Garsoppa water fall, whose height is 253 meters, is situated on this water fall, Sharavati Hydroelectric Project has been constructed.

Bharathapuzha (Bharatpuja) River – Bharathapuzha River is the largest river in the state of Kerala. It originated from the hill of Annamalai. Its total length is 250 kms, out of which 209 kms flows in Kerala and 4 km in Tamil Nadu. Its drainage area is 5,397 kms.

Periyar River- Periyar River is the second largest river of Kerala. This river originates from the Western Ghats and flows westward in Tamil Nadu and Kerala and joins the Arabian Sea. Its length is 244 kms and the drainage area is 5,243 sq kms. The Idukki Dam has been constructed on this river. The Periyar Hydroelectric Project has been developed on this. Its major tributaries are Mulayar, Muthirpuzha, Cheruthoni, Perinjankutty, Edmala River etc. Neriamangalam, Pallivasal, Paniyar, Kandalam, Chenkulam are other important dams on this river.

Also Mandvi, Guwari and Rachola in Goa; Kali river, Gangaveli, Bedti, Tadri, Netravati in Karnataka and Pamba etc. in Kerala are west flowing rivers.

(2) Rivers Falling into the Bay of Bengal

Godavari- Godavari is the largest and longest river of peninsular India. It rises from the eastern slope of the Western Ghats and flows through south-eastern Maharashtra, the Bastar Plateau (Chhattisgarh) and Telangana and Andhra Pradesh, finally draining into the Bay of Bengal north of Kolleru Lake. Its length is 1,465 kms and the drainage area is 3,12,812 square kms, out of which 49 percent of the drainage area is in Maharashtra, 20 percent in Madhya Pradesh and Chhattisgarh and 31 percent in Telangana and Andhra Pradesh. Its major tributaries are the Purna, Maner, Penganga, Wainganga, Wardha, Indravati, Tal and Sabri on its left bank. Wainganga and Wardha are jointly called Pranahita River. The main tributary found on its right bank is Manjira. After Rajahmundry in Andhra Pradesh, this river divides into many streams and falls into the Bay of Bengal and forms a large delta. It forms a deep gorge near Polavaram. It causes severe floods in the lower reaches and This River is navigable in the delta region. Many river valley projects are being implemented on this.

Mahanadi- The origin of Mahanadi comes from near 'Sihua' in Raipur district of Chhattisgarh. After its origin, the river flows towards the north-east where it is joined by the Shivnath and Sandur major tributaries. Here the river carves a deep gorge in the region where India's longest Hirakud Dam has been built. After this, at Sambalpur, the river turns east and finally joins several streams in the Bay of Bengal. Its length is 851 kms and the drainage area is 1,41,589 sq kms. Out of which 53 percent of the drainage area is in Madhya Pradesh and Chhattisgarh and 47 percent of the drainage area is in Odisha state. The lower part of this river is navigable. Where water transport is done. In this Shivnath, Hasdo, Mand, Ib, Joking and Tel are the main

tributaries. In the delta region, Brahmani and Baitarani rivers join it from the left side. The water of Mahanadi is also used for irrigation. Hirakud, Tikarpara and Naraj are major multipurpose projects on this river.

Krishna- The Krishna is the second largest river of peninsular India. It originates from a spring in the Sahyadri (Western Ghats) near Mahabaleshwar in Maharashtra. The river flows a distance of 1401 kms from its source to the mouth in Maharashtra, Karnataka, Telangana and Andhra Pradesh, forming a delta south of Kolleru Lake and drains into the Bay of Bengal. Its total drainage area is 2,59,000 sq kms, out of which 27 percent of the drainage area is drained in Maharashtra, 44 percent in Karnataka and 29 percent in Telangana and Andhra Pradesh. Its major tributaries are Koyna, Bhima, Tungabhadra, Ghatprabha, Panchganga, Dudhganga, Malaprabha, Musi etc. In this, Bhima (drainage area 76,614 square kilometers) and Tungabhadra (length 640 kilometers and drainage area 71470 kilometers) are prominent. Its bottom in Kurnool is stony and its water is pure. In the region of the delta, it brings soil along with it, due to which its water becomes muddy. Near Vijayawada, two canals have been taken out by making an anicut on Krishna. This river is very important from the point of view of hydropower projects. Its delta joins the delta of Godavari.

Pennar- The origin of Pennar River is in Kolar district of Karnataka. It has a drainage area of 55,213 square kilometers, which is situated between the Krishna and Kaveri rivers. It makes a deep pit near Gandikota. Its tributaries are Jai Mangli, Kunderu, Sagileru, Chitravati, Papashni and Cheyyaru. The entire route of the river is 570 kilometers long. This river is not suitable for boating, but its water is used for irrigation. For irrigation ponds and small drains are taken Korok. To irrigate the delta region in front of Nellore city, a 125 meter long wall has been built on the water level across this river.

Kauvery- The River rises at an altitude of 1341 m in the Brahmagiri hills near Cherangala village in Kodagu district of Karnataka. It flows south-east from its source in Karnataka and Tamil Nadu and joins the Bay of Bengal near Kaveripatnam. Its total length is 805 kms and the drainage area is 87,900 sq kms, out of which 41 percent is in Karnataka, 56 percent in Tamil Nadu and 3 percent in Kerala. Herangi, Hemvati, Shimsha, and Arkavati are the major tributaries on its left bank. While on its right bank the main tributaries of Laxman Tirtha, Kabini,

Suvarnavati, Bhavani and Amravati is found. This river holds a separate place among the rivers of the Peninsular Plateau. Because water flow remains in this river throughout the year. The reason behind this is that its upper region receives rain water from the south-west monsoon in summer, while the lower regions receive water from the north-east monsoon in summer. Due to which normal water flow is maintained in it. It forms a waterfall near Shivasamudram. Kaveri is called Southern Ganga. Its delta area (32,000 square kilometers) is highly fertile. Its 90 to 95% water capacity is being utilized by various projects. There is a dispute going on in the states of Karnataka and Tamil Nadu regarding the use of its water.

Subarnarekha River – This River originates from Piska Nagdi block in the south-west of Ranchi in Jharkhand. From its point of origin, the river enters Odisha by flowing towards the south-east and finally falls into the Bay of Bengal near Balasore in Orissa. Its length is 400 kms and the drainage basin is 19,296 sq kms. Due to the presence of gold particles in its sand, it has been named as the Golden Line. Its main tributaries are Radhu, Kanchi, Kharkai, Garanal, Jamar, Karkari etc. Subarnarekha and its tributaries form many waterfalls in their course of flow. Like- Hundru Falls (Swarnarekha River), Dasham Falls (Kanchi River), Gautamdhara Falls (Radhu River) etc. Getalsud and Chandil dams have been built on this river. India's Pittsburgh Jamshedpur city has developed at the confluence of Subarnarekha and Kharkai.

Vaitarani River - This River originates from the Gonasika site of the Gupta Ganga hill in Kendujhar district of Odisha. Its length is 365 kms. This river joins the Bay of Bengal on the left bank in the delta region of the Brahmani River in Balasore district of Orissa. This river has been mentioned in the Hindu religious texts Garuda Purana and Mahabharata. It is called the Ganges River of Odisha. Maharashtra has the Vaitarna River which originates from the Western Ghats and joins the Arabian Sea in the west.

Brahmani River – This River is formed after the meeting of the two major rivers originating from the south-west of Jharkhand, the Southern Koel and the Shankh River. The Southern Koel originates from the Ranchi plateau of Jharkhand and the Shankh river originates from the Gumla district of Jharkhand. Both the rivers flow south and meet at Rourkela in Orissa, after which they are called Brahmani River. From here the river flows through the districts of Bone, Talcher and Balasore crossing the Garjat hills and finally meets the Baitarani river near Dhasar above Paradip

port and finally flows into the Bay of Bengal. Its length is 420 kms and its drainage area is 39,033 sq kms.

In addition to the Rivers mentioned above, there are some small rivers falling in the Bay of Bengal, such as Vamsadhara, Penna, Palar, Vaigai, Tamraparni etc.

Comparison of Rivers of Northern and Southern India

The following differences can be seen between the rivers of North and South India-

(a) The rivers of North India are continuous channels, that is, they have water flow throughout the year because their water sources are glaciers, while the rivers of South India are discontinuous channels, that is, they often dry up in the dry season because they rely on rain water depends.

(b) The rivers of North India are still young and are engaged in deepening their valleys. While the Rivers of the south have attained maturity. They flow in open shallow valleys.

(c) The slope gradient of the rivers of North India is high because these rivers have not attained their base level yet. While the slope gradient of the rivers of South India is mild because these rivers have attained their base level. The exception is only those rivers where new faults have taken place, such as the Narmada River.

(d) The long course of North Indian rivers pass through rugged mountains, flat plains and marshy deltaic regions. Among these top erosion, channel change, river abduction and sliding are effective. The peninsular rivers are small, spread over plateaus and narrow coastal plains. Their routes are sure and their valleys are permanent.

(e) Himalayan rivers are examples of predecessor or Successor Rivers that have created arboreal drainage patterns in the plains. The peninsular rivers are mostly superimposed and rejuvenated which have created radial, reticulated and rectangular drainage patterns.

(f) The rivers of North India form deltas while the rivers of South India form deltas or estuaries. For example, Godavari forms the delta of the river and while Narmada river forms the Estuary.

(g) The Himalayan rivers flow over soft rocks and soil and bring fine clay and mud with them, which they spread on both sides of their banks during floods. Therefore, these areas have

become fertile which is paramount for agriculture, transport development, industrial development and urban development. In contrast, the rivers of the south flow through older hard rocks. Therefore, very little soil flows in their water hence these rivers do not make fertile plains.

(h) The rivers of North India form very few waterfalls, but almost all the rivers of the peninsula form waterfalls on the way while descending from the plateau.

(i) The water of Himalayan Rivers is used for hydroelectric power generation and for irrigation, drinking water and internal transport in the plains. While the peninsular rivers are suitable for hydropower generation in the upper basins and irrigation and navigation in the coastal plains.

3.3.1 INTERSTATE RIVER WATER DISPUTE

River water use disputes are common where a river flows from one country to another country or state. These controversies go on in many countries of the world and are still going on today. Many river water disputes in the country are going on for a long time among different states, which is a serious matter. During the British rule, irrigation projects were completely decided by the center, so inter-state river water disputes were resolved by the central government. After independence, irrigation became a state subject in India, hence every state got the right to plan, develop, manage, distribute and control the water of the rivers flowing in its territory.

Under Article 262 of the Constitution, Parliament is empowered to adjudicate and control the waters of any inter-state river. The River Boards Act, 1956 empowered the Government of India to set up boards for inter-state rivers and river basins in consultation with the state governments. Under the Inter-State Water Disputes Act, 1956, if a particular state or states approach the Center for setting up a tribunal, the central government should try to resolve the matter through consultations between the states concerned. If this does not work then the central government can set up this tribunal. That is, such water disputes can be resolved by the Central Government by a tribunal of three working judges of the High or Supreme Court. The flaw in this law was that no time limit was prescribed for the constitution of the tribunal and its decision. The Inter-State Water Disputes Act, 1956 was amended in the year 2002 to incorporate the major recommendations of the Sarkaria Commission. After these amendments, a time limit of 1 year has been made mandatory for setting up the Water Disputes Tribunal and a time limit of 3 years

for awarding the award. The Union Cabinet chaired by the Prime Minister has approved the InterState River Water Disputes (Amendment) Bill, 2019 for adjudication of disputes relating to waters of inter-state rivers and river basins. It aims to expedite the resolution of long standing inter-state water disputes by establishing a single central tribunal in place of multiple existing tribunals.

Major inter-state river water disputes in India include the Krishna river water dispute between Maharashtra, Karnataka, Telangana and Andhra Pradesh; Kaveri river water dispute between Karnataka, Kerala and Tamil Nadu; Tungabhadra water dispute between Andhra Pradesh, Telangana and Karnataka; Parambikulam, Aliyar and Bhiwani water disputes between Tamil Nadu and Kerala; Godavari water dispute between Maharashtra, Andhra Pradesh, Telangana, Madhya Pradesh, Karnataka and Orissa; Bansadhara river water dispute between Andhra Pradesh, Telangana and Odisha; Mahadayi water dispute between Goa, Karnataka and Maharashtra; Narmada water dispute between Gujarat, Madhya Pradesh, Maharashtra and Rajasthan; Mahi water dispute between Gujarat, Rajasthan and Madhya Pradesh; Ravi and Beas water disputes between Punjab, Haryana, Rajasthan, Delhi and Jammu and Kashmir; Yamuna river water dispute between Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi; Karmnasa water dispute between Uttar Pradesh and Bihar; and the Barak River water dispute between Assam and Manipur is noteworthy.

3.3.2 NATIONAL WATER GRID

The National Water Grid is a proposed project aimed at managing water resources in India and allowing more water resources to flow from one region to another in a well manner. Through this project, various water resources will be linked, such as rivers, lakes, and other water structures, which will be available in strategic and non-strategic areas.The main objective of the National Water Grid is to facilitate the distribution of water resources in different parts of India and to align the water resources. Through this, the water resources can be used for the development of the areas and the water crisis can be minimized as much as possible. Under this project, a comprehensive water infrastructure network will be developed, linking together river dams, reservoirs, and marine water structures. This will improve the management of water resources and increase the organization capacity of water resources. The project will incorporate various measures in the areas of water supply, water purification, water harvesting, water

harvesting, water conservation and water flow. The National Water Grid will be planned and implemented in a collaborative manner between the states and the central government. A guide is being prepared for the scope and interpretation of this project.

While some rivers in India are perennial, some either dry up during the dry season or have very little water in them. During the monsoon rains, floods occur in one part of the country and drought or famine is observed in other parts. These problems can be solved by the National Water Grid. Such schemes are already implemented in the country, in which (a) Periyar Diversion Scheme, (b) Kurnool-Cuddapah Canal (c) Parambikulam-Aliyar Project, (d) Indira Gandhi Canal (e) Vyas-Sutlej link canal, (f) Refractory canal from Ramganga to Ganga etc. are the main ones.

The concept of National Water Grid was first given by the famous socialist thinker Dr. Ram Manohar Lohia. In 1972, KL Rawal took this forward and gave the concept of Ganga-Kaveri Link Canal. In 1980, the Government of India prepared a perspective plan for water resources development and established the National Water Development Agency (NWDA) in July, 1982. The two main organizations of this project, prepared by the National Water Development Agency (NWDA), are: (1) connecting the river basins of the north with the river basins of the south, (2) connecting the basins of the east with the basins of the west. In one of its judgments on February 27, 2012, the Supreme Court directed the Government of India and the Ministry of Water Resources to constitute a committee headed by the Water Resources Minister to work on the interlinking of rivers programme. In this context, under the chairmanship of the Union Minister for Water Resources, River Development and Ganga Rejuvenation, a special committee on interlinking of rivers was formed on 23 September 2014 for the implementation of the river-linking programme. The National River-Linking Project will consist of 30 links connecting 37 rivers across the country through a network of about 3000 storage dams. It aims to meet the country's water needs in the future. This is a very ambitious project, under which 15 thousand kms. Long new canals will have to be built, in which 174 cubic kms. Water can be stored. The National Water Development Agency (NWDA) has been entrusted with the responsibility of designing 30 river-linking projects (of which 14 are Himalayan and the rest 16 are peninsular) under the NPP. It has two major components:

A. Development of Himalayan Rivers

- It aims to build water reservoirs on the Ganga and Brahmaputra rivers along with their tributaries in Nepal.

- Its purpose is to conserve monsoon flow for flood control as well as for irrigation and hydropower generation.

- This linkage will transfer the surplus flow of Kosi, Gandak and Ghaghra to the west.

- A link between the Ganges and the Yamuna has also been proposed to transfer surplus water to drought-prone areas of Haryana, Rajasthan and Gujarat.

Fig. 3.3: Presentation of proposed inter basin water transfer links in India.

Source: Google.

B. Southern Water Grid:

It consists of 16 links through which it is proposed to connect the rivers of South India. It envisages interlinking of Mahanadi and Godavari to supply additional water to Krishna, Pennar, Kaveri and Vaigai rivers. Many big dams and major canals will have to be constructed for this linkage. Apart from this, Ken River will also be linked with Betwa, Parbati, Kalisindh and Chambal rivers.

The Ganga-Kaveri link will be the most important component of the National Water Grid, with a total length of 2640 kms. Will be through this, the monsoon surplus water of river Ganga will be lifted from near Patna for Ganga-Kaveri link and will be transported to Kaveri basin with the help of Sone, Narmada, Tapti, Godavari, Krishna and Pennar basins. From here (near Patna) 1680 cumecs of Ganga water will be lifted for about 150 days (monsoon season). Out of this, 290 cumecs of water will be supplied to the drought-prone areas of Ganga basin in southern Uttar Pradesh and southern Bihar. The remaining water will be transported to Rajasthan, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh. To bring Ganga water to Kaveri, Vindhya Mountain has to be crossed. For this, Ganga water will have to be raised up to a maximum of 550 metres. Water will flow till the Narmada-Sone watershed through the link constructed with the help of Son. Water from Son link will be stored in Bargi Reservoir which is about 425 m on Narmada. It has been built in Mandla-Jabalpur of Madhya Pradesh at a height of. From here the water will be discharged into the Kaveri River by crossing the Krishna and Pennar Rivers through a reservoir constructed with the help of Vainganga, Pranahita and Godavari.

3.3.3 NATIONAL WATER POLICY

Water policy is a policy that is formulated by governments and provides guidance for the management, use, and conservation of water resources. Its main objectives are to ensure the security of water resources, arrangement of its use, water accumulation, water use permission, water conservation, water security and management of strategic water resources. India's first water policy came in the year 1987, which was revised in the years 2002 and 2012. The revised draft of the National Water Policy (2012) was released by the government on June 7, 2012. The main features of the water policy are as follows-

- Water is a natural resource and the basis of life, livelihood, food security and sustainable development.
- Public policies concerning water resources need to be governed by certain basic rules so that there is some commonality of approaches to planning, development and management of water resources.
- The state has the right to make appropriate policies, laws and regulations regarding water, however, there is a need to prepare a comprehensive national water-related framework law of general principles related to water.
- Water is essential for domestic use, agriculture, hydroelectric power, thermal power, navigation, recreation, etc. There should be optimum utilization of water for these different types of uses. And awareness should be spread to consider water as a scarce resource.
- The planning and management of water resources structures viz. dams, flood protection embankments, tide protection embankments etc. should include strategies to deal with the likely climate changes.
- There is a need to assess the availability of water resources and their utilization in different basins and different parts of the country in a scientific manner and review them periodically, ie every five years.
- To encourage and promote efficient use of water, a system of developing benchmarks for water use for various purposes i.e. system of setting norms for water use for purposes i.e. water consumption levels and water accounting should be developed. .
- Conservation of river basins, water bodies and infrastructure should be undertaken in a planned manner through community participation.
- Water resources projects should be planned according to efficiency criteria prescribed for different situations. Along with this, utmost emphasis should be given on the restoration of natural water drainage system.
- There is a need to remove the huge disparity between the determination of water supply in urban and rural areas.
- There should be a forum at the national level to discuss and build consensus, cooperation and conciliation on water-related issues among the State Parties.

- The sharing and management of the waters of international rivers should be discussed on a bilateral basis in consultation with the riparian states, keeping in view the overriding national interests.
- A National Water Informatics Center should be set up to collect, catalog and process hydrological data from across the country on a regular basis, and initial processing should be done, and maintained in an open and transparent manner on a GIS platform.
- Continuous research and advancement of technology must be promoted to solve the issues of water sector in a scientific manner.
- The National Water Board should prepare an action plan based on the National Water Policy as approved by the National Water Resources Council for regular monitoring of the implementation of the National Water Policy.

Through water policy, governments take appropriate decisions considering the structure, use, conservation, management and development of water resources over time and plan various measures and policies for water resources. Through this, water resources are used in a timely and sustainable manner, thereby increasing strategic and social use, as well as ensuring their conservation and management.

3.3.4 WATERFALLS AND LAKES

Water Falls

When the water of the rivers at a place falls down from the top of the steep slope i.e. the cliff at a high velocity, it is called a waterfall. This type of situation occurs when the layers of hard and soft rocks in the course of the river meet either horizontally or vertically. Because of this, the water starts falling down from the top of it. Most of the waterfalls in India are located in the states of Kerala and Karnataka. Kunchikal Falls is the highest waterfall in India, with a height of 455 meters (1,493 ft). Below is a list of some major waterfalls in India:

Table-3.2: Major waterfalls of India.

Waterfalls in India	Place	Hieght (m & ft)	Source
Kunchikal Falls	Shimoga district, Karnataka	455 m (1,493 ft)	Varahi River
Barehipani Falls	Mayurbhang district, Odisha	399 m (1,309 ft)	Budhabalanga River
Nohkalikai Falls	East Khasi Hills district,	340 m (1,115 ft)	fed by Rainwater

	Meghalaya		
Nohsngithiang Falls or Seven Sister's waterfalls or Mawsmai Falls	East Khasi Hills district, Meghalaya	315 m (1,033 ft)	fed by Rainwater
Dudhsagar Falls	Goa	310 m (1017 ft)	Mandovi River
Kynrem Falls	East Khasi Hills district, Meghalaya	305 m (1001 ft)	Thangkharang Park
Meenmutty Falls	Thiruvananthpuram, Kerala	300 m (984 ft)	Vamanapuram River
Thalaiyar Falls	Dindigul district, Tamilnadu	297 m (974 ft)	Manjalar River
Bhambavli Vajrai Falls	Satara district, Maharastra	260 m (853 ft)	Urmodi River
Barakana Falls	Shimoga district, Karnataka	259 m (850 ft)	Seetha River
Jog Falls or Gersoppa Falls	Shimoga district, Karnataka	253 m (830 ft)	Sharavati River
Khandadhar Falls	Sundargarh district, Odisha	244 m (801 ft)	Korapani Nala
Vantawng Falls	Serchhip district, Mizoram	228.6 m (750 ft)	Vanva River
Kune Falls	Pune district, Maharastra	200 m (656 ft)	Ulhas River
Soochipara Falls	Wayanad district, Kerala	200 m (656 ft)	Chaliyar River
Mogad Falls	North Kannada district, Karnataka	198 m (650 ft)	Bedti River
Bahuti Falls	Mauganj, Rewa district, Madhya Pradesh	198 m (650 ft)	Seller River
Joranda Falls	Mayurbhanj district, Odisha	181 m (594 ft)	Duduma River
Hebbe Falls	Chikmangalur district, Karnataka	168 m (551 ft)	Bhadra River
Duduma Falls	Koraput, Odisha	157 m (515 ft)	Machhkund River
Palani Falls	Kullu district, Himanchal Pradesh	150 m (490 ft)	Beas River
Lodh Falls	Latehar district, Jharkhand	143 m (469 ft)	Burha River
Bishop Falls	East Khasi Hills district, Meghalaya	135 m (443 ft)	Umiam River
Chachai Falls	Rewa district, Madhya Pradesh	130 m (430 ft)	Bihad River
Keoti Falls	Rewa district, Madhya Pradesh	130 m (430 ft)	Mahana River
Kalhatti Falls	Chikmangalur district, Karnataka	122 m (422 ft)	Sharawati River
Beadon Falls	East Khasi Hills district, Meghalaya	120 m (390 ft)	Umiam River
Keppa Falls	North Kannada district, Karnataka	116 m (381 ft)	Aghanashini River

Koosalli Falls	Udui district, Karnataka	116 m (381 ft)	Seeta River
Dabbe Falls	Shivamogga district, Karnataka	110 m (360 ft)	Tunga Rivers
Silver Falls	Pachmarhi, Madhya Pradesh	107 m (351 ft)	Water seeping from the plateaus
Bundla Falls	Kaimur district, Bihar	100 m (330 ft)	Bundla River
Shivanasamudra Falls	Chamrajnagar district, Karnataka	98 m (322 ft)	Kaveri River
Lower Ghaghri Falls	Latehar district, Jharkhand	98 m (322 ft)	Auranga River
Hundru Falls	Ranchi district, Jharkhand	98 m (322 ft)	Subarnarekha River
Sweet Falls	East Khasi Hills district, Meghalaya	96 m (315 ft)	fed by Rainwater
Agaya Gangai Falls	Namakkal, Tamilnadu	92 m (302 ft)	Aiyaru River
Gatha Falls	Panna district, Madhya Pradesh	91m (299 ft)	Ken River
Teerathgarh Falls	Baster district, Chhattishagarh	91 m (299 ft)	Kanger River
Kiliyur Falls	Yercaud, Tamilnadu	91 m (299 ft)	Periyaru River
Kudumari Falls	Udupi district, Karnataka	91 m (299 ft)	Aghanashini River
Muthyala Maduvu Falls	Banguluru	91 m (299 ft)	Onakanahalli Tank
Langshiang Falls	Western Khasi Hills district, Meghalaya	85 m (279 ft)	Kynshi River
Talakona Falls	Chittoor district,	82 m (269 ft)	Talakona River
Kakolat Falls	Nawada district, Bihar	50 m (160 ft)	Lohbar River
Athirappilly Falls	Thrissur district, Kerala	25 m (82 ft)	Chalakudy River

Source: Google.

Lakes

Generally, lakes are those wide pits of the surface, in which water is filled. We can generally present the following definition of a lake – 'Lakes are those stable parts of water which are surrounded by land blocks from all sides and are situated in the land part. Another characteristic of the lake is its impermanence.' Lakes are formed & developed. Gradually, they get filled with sediment and turn into marshes and when uplifted, they become equal to the nearby land. In this way it can be said that there are temporary forms of stagnant water at the lake site. India has abundance of natural and artificial lakes and reservoirs. The lakes found here are surface changes, volcanic eruptions, glacial erosion, land sliding and wind formation.

Most of the lakes of India are found in the northern mountainous region only. The largest number of lakes in India are in the Kumaon Himalayas. Major lakes in India include Wular, Dal, Gadsar, Anantnag, Berinag, Sheshnag, Kausarnag, Nagin, Pongogchho, Si-Moriri, Gangabal and Manasbal in the state of Jammu and Kashmir; Bhrigu, Machhiyal, Renuka, Surajtal and Chandra Tal in the state of Himachal Pradesh; Nainital, Dodital, Bhimtal, Sattal, Naukuchiatal, Devtal, Khurpatal, Rakasatal and Mala in the state of Uttarakhand; Sukhna Lake in Chandigarh; Rajsamand, Jaisamand, Nakki, Sambhar, Fatehsagar, Lunkarsar, Didwana, Pichhola, Anasagar, Kuchaman, Dhebar and Pushkar in Rajasthan; Lonar and Powai in Maharashtra; Bellandur in Karnataka; Bembanad and Ashtamudi in Kerala; Songma and Cho-Lhamu in Sikkim; Loktak in Manipur; Chilka in Orissa; Hussain Sagar and Nagarjuna Sagar in Telangana; Kolleru and Pulicat in Andhra Pradesh; Kodaikanal and Kaliveli in Tamil Nadu and Surajkund in Haryana are the lakes.

Chilka Lake (Odisha) is the largest brackish water lake in India. Chilka is a lagoon lake, due to which its water is brackish. Pulicat Lake is the second largest brackish water lake in India. Sometimes the mouth of lagoon lakes gets blocked due to marine sediments, in such a situation; lagoon lakes do not have direct contact with the ocean. For example – Kolleru Lake situated between Godavari and Krishna river delta. Sriharikota Island is located in Pulicat Lake itself, on which the Satish Dhawan Space Center established by the 'Indian Space Research Institute' is located. There is an island in Bembanad Lake, which is called Wellington Island. Rowing competition in Kerala is held from Wellington Island in Bembanad Lake. The lagoon lakes of Kerala are locally known as Kayals. The largest fresh water lake in India, Wular Lake is located in the state of Jammu and Kashmir. The Jhelum River rises from the Berinag Lake and passes through the Wular Lake in Srinagar. Oxbow lake is formed by rivers, in other words Jhelum River itself has formed Wular Lake. Wular Lake is an example of an oxbow lake. Tectonic action also has an effect in the formation of Wular Lake. The internal action taking place inside the earth is called tectonic action. Most of the lakes of Rajasthan state are saline. The lakes of the state of Rajasthan have been created by the winds. Lonar Lake located in the state of Maharashtra is a lake formed by volcanic activities. A lake formed by volcanic activity is called a crater lake. Loktak Lake is the largest fresh water lake in Northeast India; it is located in the state of Manipur. Kebullamjao is a floating national park located in the state of Manipur.

Tso-Lhamo Lake, situated at an altitude of 18,000 feet in the northern part of Sikkim, is the highest lake in India.

3.4 SUMMARY

India's drainage system is critical to the use, management, control and development of the country's water resources. The system focuses on the Indian sub-continent's runoff diversity, changing water flow direction, flow activities of rivers, construction of dams, engineering projects, river monitoring, water management policies, climate change impacts and many more. The main rivers of India like Ganga, Yamuna, Brahmaputra, Narmada, Kaveri and Krishna etc. are important streams of the drainage system of the country. The water of these rivers travels to different parts of India and plays an important role in agriculture, drinking water, industrial use, river cleaning, tourism, and climate balance. India's drainage system is managed by both the central and state governments. India's drainage system is protected and maintained through dams, water flow control structures, water monitoring systems, and water management policies built by the Indian government.

In addition, the Government of India also pursues initiatives such as river conservation, water conservation, official development of water resources and river cleaning campaigns for environmental protection. India's drainage system faces several challenges, such as water crisis, diminishing diversity of water resources, water pollution, water way security, impact of climate change and resolution of water disputes. Faced with these challenges, efforts should be made to strengthen the drainage system by using proper management, science, technology, and strategic strategies.

India needs to make safe, sustainable and systematic use of water resources through drainage system to meet the needs of the country as well as development of water structures, water roads, river dams, barrages, and water projects. In addition, it also helps in the protection of rivers, waterways traffic, industrial use, tourism, drinking water supply and protection of the strait environment. Thus, management of India's drainage system is important so that the country can conserve water resources, solve water related problems and ensure development.

3.5 GLOSSARY

Barrage - A reservoir of water constructed for the purpose to have regular flow of water in the river

Brahmputra - Son of Brahma

Dam - Reservoir with the purpose to generate power and water for irrigation

Delta - Rivers is splited into a number of channels before joining the sea

Dhuandhar - Waterfall on Narmada, with full mist

Drainage - Flow of water on the surface

Estuary - Tidal mouth where a main river directly join the sea.

Gorge - Narrow & deep valley

Indo-Brahm - Indus + Brahmputra

Kaveri - Ganga of the south

Meander - Leisurely flow of river or big loops of river.

River system - A group of rivers, which are inter connected

Tethys Sea - Extended between Angaraland and Gondwana land

Tsangpo - Indus

3.6 ANSWER OF CHECK YOUR PROGRESS

1. Drainage-Nature of flow of water in the rivers.

2. Rivers- cradle of civilization, and as running water.

3. Ancient and religious towns have developed along rivers.

4. Indian Rivers have made changes in their flow since ancient times.

5. Indo-Brahm was an ancient river.

6. E.G. Pilgrim gave the name of Shiwalik River to Indo-Brahm River.

7. Formations of Himalayas have affected the courses of Indian Rivers.

8. Saraswati, Sutlej and Yamuna Rivers once were having their flow in Rajasthan.

9. Brahmputra is known Tsangpo in Tibet.

10. Flow of rivers has an effect of nature of surface, degree of slope, amount of water.

11. Himalayan River System is formed by Indus, Ganga and Brahmputra.

12. Indus River rises near Mansarovar Lake in Tibet.

13. Indus makes a gorge of 5180 m deep near Gilgit.

14. Shigar, Shyok and Gilgit are the main tributaries in Indus in Kashmir state.

15. Indus River is 2880 kms long

16. Jhelum, Chenab, Ravi, Beas and Sutlej are its main tributaries in the plain.

17. Jhelum rises at Verinag in Kashmir.

18. Jhelum River flows from Kashmir valley. Srinagar is on its bank.

19. Chenab River is the name of two rivers-Chandra and Bhaga.

20. Ravi and Beas have their origin from the hills of Himachal Pradesh.

21. Sutlej has its origin beyond the Great Himalayas.

22. Ganga River System is the most important river system.

23. The confluence of Bhagirathi and Alaknanda gives birth to Ganga.

24. Ganga River is 2515 kms. long.

25. Yamuna is the main tributary of River Ganga, and joins it at Allahabad.

26. Ramganga, Ghaghra, Rapti, Gandak and Kosi are main tributaries of Ganga.

27. Chambal, Betwa, Ken, Kalisindh are peninsular rivers and join Yamuna in Great Plains.

28. South Tons, Son and Damodar Rivers are as peninsular rivers and join Ganga.

29. Chambal River is known for Ravines.

30. Damodar River, a river of Chhota Nagpur Plateau, is known for Damodar valley project.

31. Brahmputra River rises near Mansarover Lake and flows in Tibet as Tsangpo.

32. Brahmputra is a braided river as it forms many islands in its channel.

33. Peninsular Rivers, which flow towards Bay of Bengal form wide deltas.

34. Mahanadi, Godavari, Krishna and Kaveri are the rivers which form deltas.

35. Narmada and Tapi Rivers form estuaries in Arabia Sea.

36. Sabaramati and Mahi Rivers after flowing in Gujarat fall in Arabian Sea.

37. Rivers originating from western state are small steep and form waterfalls.

38. Jog falls of Shrawati River is known for power project.

39. Thar Desert and cold desert of Aksai chin are known for inland drainage.

40. Major River Basins are 14 in number. All the main rivers are of this category.

41. Medium River Basins are 44 in number. Mostly, these are in Peninsular India.

42. Minor River Basins are 55 in number and are extended on the Western Ghats.

43. Himalayan Rivers are perennial, while peninsular rivers are non- perennial.

3.7 REFERENCES

Mamoriya, C. (2000), Advance Geography of Modern India, Sahitya Bhawan Publishers and Distributers Li., Agra.

Shreewastav, V.K. (2015), Regional Planning & Balanced Development, Vasundhara Prakashan, Gorakhpur.

Singh, Savindra (2020), Physical Geography, Pravalika Publication, Prayagraj.

Tiwari, R.C. (2016), Geography of India, Prawalika Publications, Prayagraj.

https://indiawris.gov.in/wiki/doku.php?id=river_basins

3.8 TERMINAL QUESTIONS

(A) LONG ANSWER

1- Give a detailed account of Ganga river system.

2- Explain Penninsular drainage system.

3- Elaborate National Water Grid project.

4 - Comment on National Water Policy and it's features.

5 - Gave an elaborative account of Himalyan Drainage System.

(B) SHORT ANSWER

1- Into how many parts have the rivers of India been divided on the basis of river basin?

2 - Explain the origin of the Himalayan drainage system.

3- Explain about Indus river system.

4 - Give information about the rivers originating from the plateau of Ganga river system.

5 - Briefly describe the Brahmaputra river system.

6 - Compare between the rivers of North India and South India.

7 - Explain the inter-state water dispute.

8- Describe the famous lakes of India.

9 - Explain the importance of drainage system.

(C) MULTIPLE CHOICE QUESTIONS

1- From where does the Chenab originate?

(a) Rohtang Pass

(b) Khardung La

(c) Nathu La

(d) Bara Lacha Pass

2- Which one of the following forms the boundary between Nepal and Kumaon?

(a) The Chambal

(b) The Damodar

(c) The Ghaghra

(d) The Kali

3- Which of the following river does not flow in Goa state-

(a) Kalindi (b) Mandavi (c) Zuari (d) Rachol

4- Where does the Chambal rise?

(a) Dewas

(b) Dhar

(c) Khargone

(d) Mhow

5- Shivasamudram waterfall is situated at which of the river-

(a) Krishna (b) Periyar (c) Kaveri (d) Mandavi

6- In which year the National Water Policy was amended?

(a) 2010 (b) 2011 (c) 2012 (d) 2013

Answer– 1 (d), 2 (d), 3 (b), 4 (d), 5(c), 6(c).

UNIT 4 - CLIMATE

4.1 OBJECTIVES

After having the detailed study of this unit you will be able to:

- To understand the climate and dynamics of climate of India.
- To know about the climatic regions of the country.

4.2 INTRODUCTION

The climate of a country includes the study of temperature, rainfall, atmospheric pressure, as well as the direction of velocity of winds over a long period of time. These elements of climate are largely influenced by the location, nature of surface, areal distribution of land and water. India is a large country which results in sharp climatic contrasts. The great extent and location have provided diversion in our climate. It is not very easy to study the climate of India very deeply, as because half of its part lies in the north of Tropic of cancer, which is virtually the part of temperate zone from the thermal point of view. But the presence of Himalayas in the north has made India a tropical country, as these have been proved as an effective meteorological barrier, and thus India shares the characteristics of Tropical Monsoon climate. This climate is a rhythm of seasons, originated by Monsoon seasonal winds. These winds have given unity to our climate, but the location, physiography, its vastness have given regional variations, expressed in the pattern of winds, temperature and rainfall, rhythm of seasons and the degree of wetness or dryness. The comment of Blanford on these climatic diversities seems to be correct that we may speak of the climates but not the climate of India, for the world itself affords, no greater contrast than is to be met with at one and the same time within its limits." Marsden too believed that India possesses all type of climate found in the world.

4.3 FACTORS INFLUENCING THE CLIMATE OF INDIA

India's climate is characterized as 'Tropical Monsoon' clearly indicating upon it the dominant influence of the country's latitudes and the monsoon winds. Changes in the upper air circulation during the year and Himalaya Mountain relief are the other important factors affecting it.

Climatic Contrasts

1. The day temperature in the month of June in arid regions of Rajasthan occasionally shoots to 500C, while on a severe winter night at Dras near Kargil, the minimum temperature shoots upto 400C.

2. Cherrapunji receives the annual rainfall of 1080 cm., while at Jaisalmer in Rajasthan, the annual rainfall rarely exceeds 12 cm.

3. The coastal regions are known for their equable and moderate climate, whereas the great plains have the climate of contrast seasons- winter and summer.

4. North India gets rain from western disturbances in winter season, while Tamilnadu and Andhra Pradesh coasts receive rainfall from retreating monsoon in November and December.

5. Farmers of Jammu & Kashmir have to face severe cold in the months of December to February, while on the other hand farmers of Kerala coast do enjoy these months in their farms with only dhoti wearing as Lungi.

6. Brahmaputra valley receives heavy rainfall in June, whereas the farmers of Bihar and Uttar Pradesh have to work in their farms in the scorching heat of the sun.

Inspiteof all these diversities, Indian climate has been pronounced as Tropical Monsoon Climate. L.D. Stamp has said that 'we have always considered India, a tropical country; it is true because it is surrounded in the north by the mountain wall, in which one type of climate prevails i.e. Tropical Monsoon Climate'. This climate has contrast seasons especially south-west wind in summer and north-east winds in winter. Reversal of wind system is the basic principle of Monsoon climate. This climate is influenced by a number of geographical factors. It is also affected by those factors which lie much beyond its geographical limits. Some of the factors are briefly discussed as under.

1. Location and Latitudinal Extent- The mainland of India is extended between 80N and 370N. The tropic of cancer passes through the middle of the country. More than half of the area lies in the tropics and all the remaining in the sub-tropics. Areas south of tropic of cancer experience high temperature throughout the year. Areas north of this parallel enjoy warm sub-temperature climate, as because, these areas are surrounded by Himalayas in the north. Here, some places in the winter season record considerably low temperatures. The coastal areas have mild climate.

2. Distance from the Sea- With a long coast line, large coastal areas have an equable climate. On the contrary, interior locations are deprived of the moderating influence of the sea and experience extreme or continental climate. For example, the annual range of temperature at Thiruvanantpuram does not exceed 50C whereas it is as high as 250C at Delhi. Similarly, the amount of rainfall at Shillong is more than 250 cms which falls to a low of 25 cms at Jodhpur.

3. Influence of Physiography- Physiography of India has a great bearing on major elements of climate such as temperature, atmospheric pressure, direction of winds, and the amount of rainfall. In fact, the physical map of India is very closely related to our climatic conditions, Monsoon winds from Bay of Bengal are bifurcated into two branches by the physiographic features. One branch goes to Assam valley

through the Meghalaya Plateau and the other branch enters the plains through the Chhota Nagpur Plateau.

(a) Himalayan Mountain Range plays an important role in lending a sub-tropical touch, the climate of this region. The lofty mountains form a barrier that separates India from the rest of Asia. These ranges protect us from the bitterly cold and dry winds of central Asia during winter and thus make winter less cold than north and central Asia. Further, these mountain ranges act as an effective physical barrier. They trap the monsoon winds forcing them to shed their moisture within the country. As a result, the Great plains receive heavy rainfall, while central Asia lies in the 'rain shadow' of the Himalayas.

(b) The south west Monsoon winds from the Arabian Sea strike almost perpendicular to the Western Ghats and cause heavy rainfall in the western coastal plain and the western slopes of Western Ghats. On the contrary, vast areas of Maharastra, Karnataka, Talangana, Andhra Pradesh and Taimilnadu lie in rain shadow or leeward side of the Western Ghat and receive scanty rainfall. Here Manglore, along the coast gets the rain nearly 280 cms whereas Bengaluru receives only 50 cm rainfall.

(c) Aravalli Hills run parallel to the direction of the south-west monsoon winds. As such moisture laden winds pass through Rajasthan without shedding their moisture. This accounts for Rajasthan dry climate. Bay of Bengal monsoon also reaches here, when its moisture content becomes less or declines.

(d) The hills of Mehgalaya Plateau force the moisture laden winds coming from the Bay of Bengal to shed their moisture before proceeding northwards. As a result, the south of Assam gets heavy rainfall while the north is comparatively dry.

4. Altitude- Temperature decreases with the increase in height. For every 165 m ascent, the temperature falls by 10C. Hence places in the mountains are cooler than places on the plains. It is because that the places located at higher altitudes even in Peninsular India have cool climate. Ooty and several other hill stations of Peninsular India and of the Himalayan Ranges like Mussoorrie, Shimla are much cooler than the places located in the Great Plains. Mount Abu of Aravalli Hills is much cooler than the adjoining desert plains of Rajasthan.

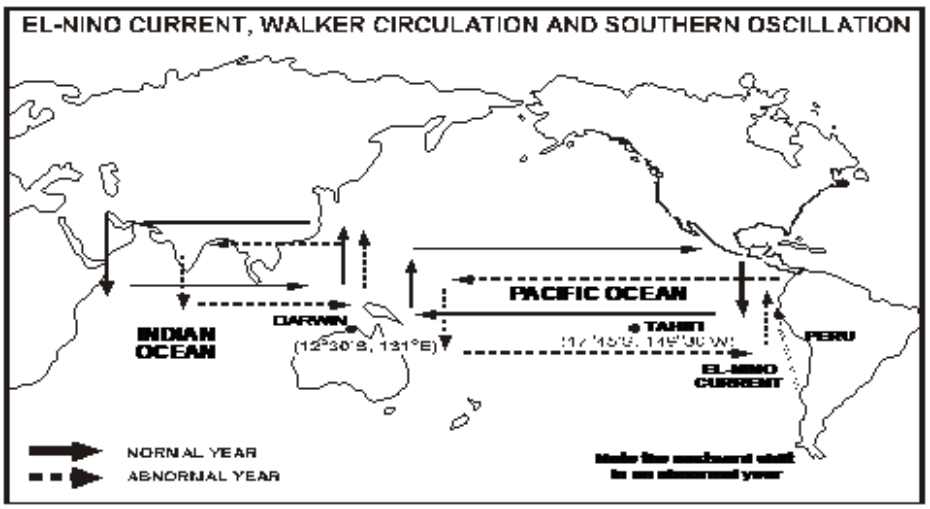
5. Monsoon Winds- The most dominant factor of the Indian climate is the monsoon winds as a result of which it is called as monsoon climate. These winds are the seasonal winds that in the sum of summer and winter winds. India remains in the influence of these winds throughout the year. They represent simply a land and sea breeze on a large scale, and that the annual period of the Monsoon corresponds to the diurnal period of the breezes. Monsoon are the strong wind stream, which blow on South Asian coasts from April to October and then flow in reversal form towards north-east direction with a slow speed.

6. El-Nino Effect- Recent studies have revealed that there are certain other factors in affecting the origin of monsoon, which happen at long distances and with large intervals of time. These are known as metrological tele-connections. The one is El-Nino. This is a warm ocean current of appearing along the Peru Coast in December. It affects the surface temperature of Southern Pacific Ocean. El-Nino is a Spanish Word and is defined as child chariot or child of crime. It is developed due to increase in temperature of South Pacific Ocean. The presence of this current was known for the first time in 1983. The increase in temperature of South Pacific Ocean helps in the deficiency of Monsoon rainfall in India. This current flows during the Christmas Season. It has its flow along western drift of cold Peru Current, and thus gives birth to Pacific Equatorial Counter current. El Nina current affects the temperature of Indian Ocean. The increase in surface temperature of Indian Ocean Weakens South-west Monsoon and thus declines the probability of monsoon rains in India.

In recent times, there is a high increase in green house gases in the atmosphere. This incidence is related with global warming. This change has its bearing on the frequency of El-Nino. Every fourth or fifth year, this warm current tries to weak Indian Monsoon. Prof. G.C. Chaudhary has said that these currents flow at an interval of three to seven years, and they affect the climate of a vest area, extended upto 100 latitude on both sides of Equator. These currents also affect the coral's life and plankton of fishes in the ocean. These are responsible for long Monsoon gaps, drought conditions in India. Sometimes, their favorable conditions help in heavy monsoon rains.

7. La-Nina- After an El-Nino, weather conditions return to normal. However, sometimes trade winds become so strong that they cause abnormal accumulation of cold water in the central and eastern pacific region. This event is called La-Nina, which in effect is the complete opposition of El Nino. A La-Nina also moves an active Hurricane season. In India, its presence porteds exceptionally good news. It is the harbinger of heavy monsoon showers in India.

Fig. 4.1: El-Nino, Walker circulation and southern oscillation (by D.R. Khullar).



8. Southern Oscillation- It explains the linkages between the pacific and Indian oceans. These relations were discovered by Sir Gilbort Walker in 1920. It is observed that whenever the surface level pressure is high over the Indian Ocean, there will be low pressure over the pacific ocean and vice versa. This inter-relation at high and low pressure over the pacific and the Indian Ocean is called southern oscillation. The low pressure conditions in Indian Ocean is observed in winter, indicate the conductive to good monsoon rainfall in India. This situation will help in good monsoon rainfall in India. On the other hand, if Indian Ocean has high pressure, whereas Pacific Ocean has the low pressure, such condition will be conductive to weak monsoon rainfall. Such position is defined as El-Nino year. Sir Gilbert Walker, due to close association between change in pressure conditions of both the oceans, and the effect of El-Nino current has referred it as ENSO.

9. Tropical Cyclones- These originate in Bay of Bengal and Arabian Sea and influence primarily a larger area of south and central India. The number of such cyclones is more in Bay of Bengal. These cyclones become disastrous on the eastern coast. Their frequency is more during the onset and offset of monsoon seasons. During the months of June to September, their frequency is three to four, per month.

These cyclones are now called by different names. The list of these names was prepared by South Asian countries. These are named as Pyar, Fayan, Catrina, Laila, and Iola and so on. The cyclone of 3-6 October 2014 was called by the name of Hud-Hud, which affected Odisha and Andhra Pradesh on 31 October, 2014. Nilober cyclone of Arabian Sea effected Gujarat coastal area. These cyclones are quite violent and some-times become highly destructive and cause the loss of life and property.

10. Western Disturbances- These are also known as temperate cyclones. These originate over the Mediterranean Sea and travel eastward under the influence of Westerly Jet Stream. They bring a small amount of rainfall which declines from west to east. They leave their effect on winter weather conditions of most of the Great Plains and Western Himalayan Region. The Westerly Jet Stream plays an impressive role in descending them towards North-West parts of India. Their frequency is observed four to five per month between November and April. They also cause rainfall in the hilly region and, thus, bring sudden drops in the temperature. The rains are highly useful to Rabi crops. Some- times widespread frosts result in the damage of crops.

4.3.1 THE MONSOON

The term Monsoon has its origin from the Arabic word Mausim or Malayan word Monsoon, which means ‘season.’ In sixth and seventh century, Arabian navigators used this term for those winds which blow from north-east direction for six months and for remaining six months from south-west direction in Arabian Sea. These winds were noted in the area lying between India and East Africa. In the end of

15th century, Arabian people used south-west winds during the journey of Kalikut by Vasco-da-Gama. In 1686 Edmund Halley had forwarded has view on Asiatic Monsoon in Royal Society of England that the reversal in Monsoon winds is the result of the process of surface temperature. Monsoons are seasonal winds on a large scale, which change their direction according to seasons. These are the alternating thermal winds affecting the lower layer of the atmosphere. The term Monsoon has been used in singular and plural forms.

Forms and Meaning of Monsoon

(i) Singular Form- In India, the word Monsoon is used frequently for the rainy season and is defined in terms of rainfall alone. It is the opinion of few scholars that the winds blowing from south-west in summer season are called Monsoon winds. Thus, Monsoon is a westerly air flow of summer. In 1945, Eaker has said that, the whole airmass crossing the equator is deflected and will be called the monsoon- as distinct from the trade wind which is not deflected as it has not crossed the equator. In 1951, A. Grims has defined Monsoon as deflected trade winds. South-east trade winds are responsible for the origin of Monsoon. These winds change their direction at the time of crossing the Equator, due to Coriolis force of the earth.

(b) Plural Form- Most of the scholars have used this term for two types of winds- i.e. one, Summer Monsoon winds, and second Winter Monsoon winds. Thus, the Monsoon is a double system of seasonal winds. Koppon (1923), Hann (1932) and Angot (1943) have said that the Monsoon represents simply a land and sea breeze on a large scale, and that the annual period of the Monsoon corresponds to the diurnal period of the breezes.

Conrad- A true thermal Monsoon demands a complete reversal of winds that is an angle of about 1800 between the dominant winds at extreme season:

The origin of these seasonal winds is still shrouded in mystery, and a number of theories have been propounded by a number of scholars. Their views are flexible and dynamic. Monsoon has three main features:

(i) Reversal in the direction of Monsoon winds with the season.

(ii) Reversal in direction due to variation in temperatures of land and water.

(iii) Monsoon winds in summer season are rainy.

The views expressed, thus may be categorized into following three theories: (i) Classical Concept, (ii) Air mass concept, (iii) Perturbation concept.

(i) The Classical Concept- It is based on the variation in temperature of sea and land. Monsoon is a result of thermal contrasts. It is connected with thermal variations of the

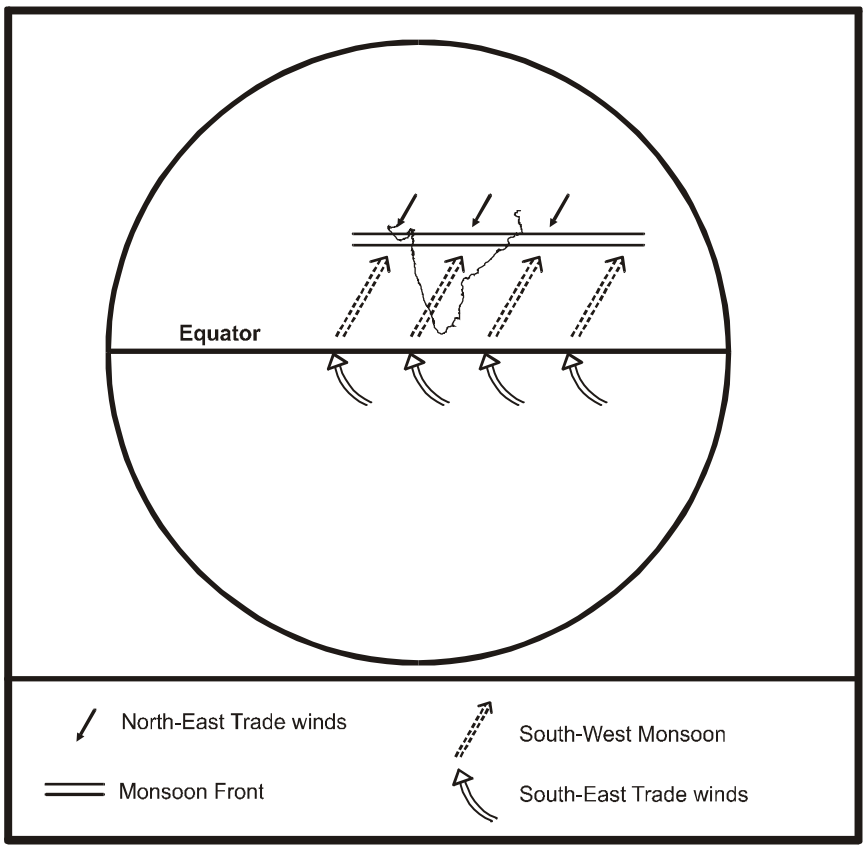
continents and oceans. This is a thermal concept. This concept is based on two essentials-

(a) Presence of land and water: If there was no variation of land and water on the surface, there was no possibility of its origin.

(b) Change in seasons: This is responsible for the change in wind directions.

During the summer season, these winds blow from Indian Ocean to Indian landmass and in winter season from the Indian landmass to Indian Ocean. Their direction is affected by the rotation of the earth on its axis. It means that these winds take eastward turn after crossing the Equator, and thus south-east trade winds become south-east winds.

Fig. 4.2: Origin of S.W. Monsoon in Northern Hemisphere.



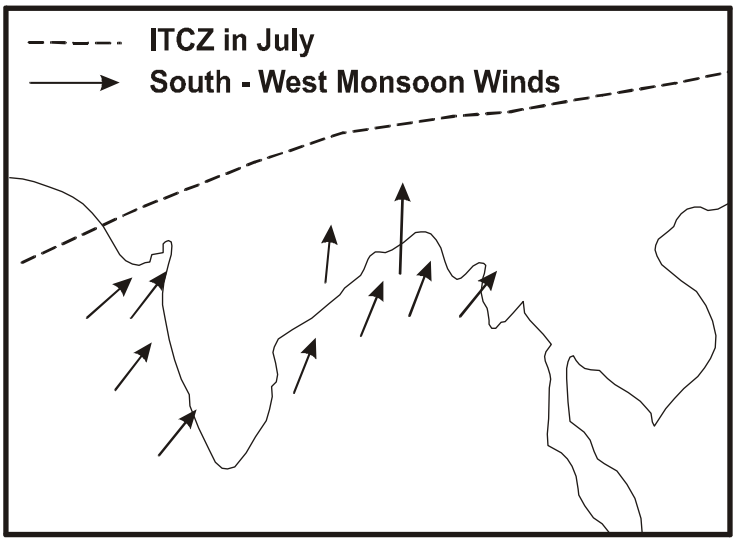
This concept is logical and acceptable, but it does not highlight the changing nature of Monsoon.

(ii) The Air Mass Concept- This concept is based on the contraction and expansion of Planetary Air Currents. This dynamic concept was developed by Flohn in 1951. He argued that Monsoon is only the seasonal migration of planetary winds and pressure belts following the position of sun. During the summer solstice, the sun's rays fall vertically over the Tropic of cancer. Consequently, all the pressure and wind belts of

the globe shift northwards. At this time Inter-Tropical Convergence (ITC) moves northward, and major part of Indian landmass comes under the impact of equatorial westerlies, which are called south-west monsoon. During the winter season, the pressure and wind shift southward, thereby establishing the north-east monsoon (trade winds) over this region. Such systematic change in the direction of planetary winds is known as monsoon.

According to spate, the origin of monsoon is in accordance to the theory of the origin of cyclones. These monsoon cyclones originate due to accumulation of three fast moving Air currents- First-new humid monsoon Air currents, Second- old monsoon current of low temperature and more humid, Third-continental tropical Air Current, which is developed between old and new monsoon currents and, thus, a front or convergence is originated and a cyclonic air current is developed.

Fig. 4.3: Inter tropical front.



A group of scholars has explained the origin of Inter-Tropical Convergence, and has related with the origin of monsoon. The north-ward migration of this ITC is an important factor influencing particularly the onset and intensity of south-west monsoons. The ITC shifts northward in summer season and has its position on north part of India. It's shifting towards north on the increase in temperature. This ITC is sometimes called as monsoon trough. It leaves its influence on the distribution of rainfall and also on the route of monsoon cyclones.

ITC changes its position in winter season. It is shifted towards the Equator. North India comes in the influence of North-East trade winds. When these winds cross Bay of Bengal gain moisture, and thus provide rains to Eastern Coastal areas. The ITC is contracted, when it reaches near to Equator. In real sense, this ITC is a zone of low pressure separating the north-east winds with the south-east trade winds. The position and presence of this zone affect the direction and amount of rainfall

mainly in summer season. Flohn is of the view that reversal in Monsoon winds is not based on thermal changes; rather it is based on reinstallation of planetary trade winds.

(iii) The Perturbation School or Jet Stream Concept- It is a recent concept mainly developed after 1950. This concept is based on the role of Jet Streams, Tibet Plateau, and the ocean bodies in explaining the origin monsoon. The following shortcomings of monsoon attract us to study its origin:-

(a) The variability in summer rainfall

(b) Uncertainty in time of rains

(c) Number of rain days to be less in rainy months

(d) Uncertainty in the onset and off time of monsoon rains.

This concept is propounded by a number of Indian and foreign scholars among them Koteswaram, M.T. Yin, Parthsarthy. Flohn, Raman and Ramnathan are noteworthy. Here, it is important to know about the meaning of Jet Stream.

Meaning of Jet Stream- These are circum-polar air currents. These winds flow in both the hemispheres between winter 200N-350C in northern hemisphere and summer the surface. These are also Air Rivers, which were identified by American Pilots of aircrafts B-29 (Jet) during the Second World War. They were compelled to face these strong winds, which affected the speed and direction of their aircrafts.

These streams are named after Jet Aircraft, which is known for its speed and flight at high attitude. Thus are defined as follows-

Definitions

1. Jet streams are upper air circulation winds and blow just like an ocean current. They blow in certain direction with definite width.

2. The meandering narrow and strong speedy air current of Upper Troposphere are known as Jet Streams.

3. Kendrew- Jet stream is a strong air belt found in both the hemispheres.

4. Trewartha- Jet stream is a vast air current, which blow with a great velocity from west to east direction.

Characteristics

(i) Jet stream winds blow at an altitude of 6000-12000 mts.

(ii) They change their location according to season. They shift towards near Equator in winter season and towards poles in summer season.

(iii) They blow from west to east in westerlies belt.

(iv) These have high variation in speed.

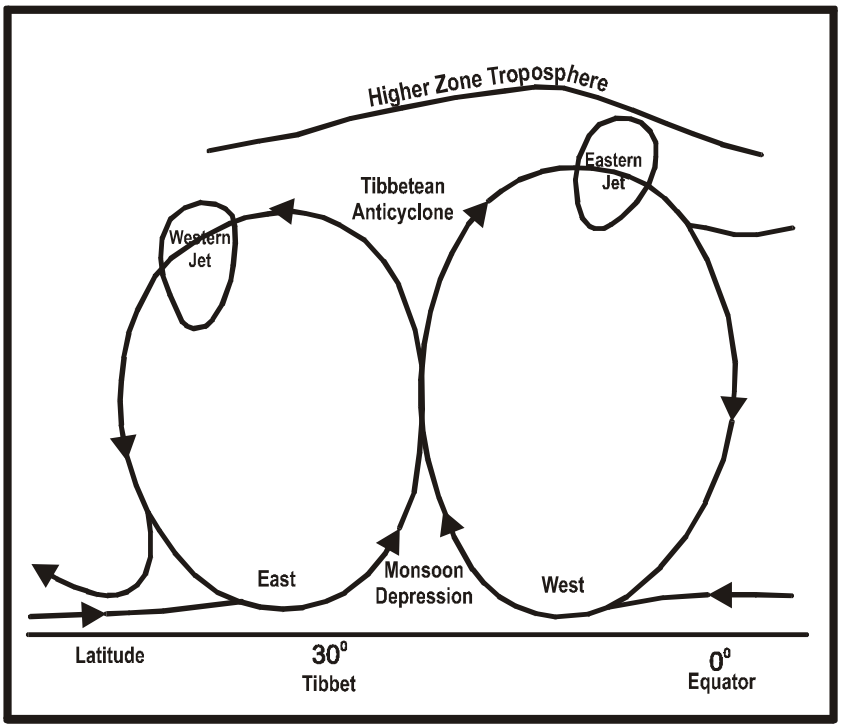
(v) Their speed is high in the central part than the sides.

(vi) The speed is 64 kms per hour in winter and 24 km per hour in summer. Near axis the speed is very high.

Effect on Weather- There is intense relations between weather and Jet Stream. It affects on the activeness of Monsoon. It forces monsoon winds by putting pressure on the surface winds. These also leave their impact on the increase or decrease of rainfall and also on its uneven distribution. All these effects have been discussed by the scholars in different ways.

N.M.T. Yin presented his theory on the origin of Monsoon in 1949. He determined that burst of monsoon depends on-

Fig. 4.4: Origin of summer monsoon jet stream.



(i) The movement of upper air of monsoon trough of Bay of Bengal towards west means from 90oE to 80oE longitude.

(ii) The movement of low latitude western Jet Stream towards north.

(iii) The effect of the location of the pressure of North hemisphere winds.

He forwarded his views that burst of Monsoon depends upon upper atmosphere condition. The change in the position of low latitude axis trough from 90o E to 80o E, affects the movement of winds in Northern Hemisphere, and this situation invite the burst of monsoon. This is caused due to northward shift of western Jet Stream in north. In summer, this western Jet Stream has its effect in north. Its south branch, when it starts to proceed towards north, causes heavy rainfall by south west monsoons.

P. Koteswaram propounded a new hypothesis on the origin of monsoon in an article entitled, "The Easterly Jet Stream in the Tropics" in 1958. He emphasized that Tibet Plateau affects the atmosphere in two ways: (a) as a meteorological barrier, and (b) as a high level heat sources.

He established the relationship between the monsoon and atmospheric conditions prevailing over Tibet Plateau. It becomes hot in summer and is 2oC to 3oC warmer than the air over the adjoining regions. It generates an area of rising air. During its ascent, the air spreads outwards and gradually sinks over the equatorial part of the Indian Ocean. At this stage, the ascending air is deflected to the right by the earth's rotation and moves in an anti-clockwise direction leading to anti-cyclonic conditions in the upper troposphere over Tibet. When these winds approach the west coast of India, they form south-west direction. After gaining the moisture from the Indian Ocean causes heavy rainfall in India and adjoining countries.

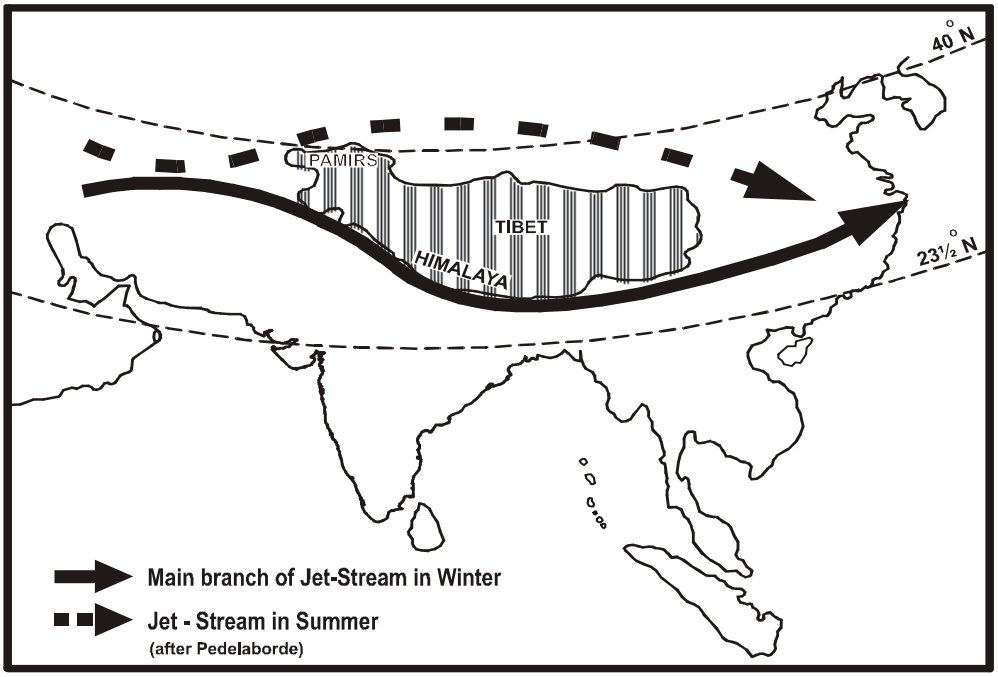
Thus, it is revealed that intensity and heating of Tibet Plateau has a direct bearing on the amount of rainfall in India by the monsoons.

Monex means monsoon expedition. It has confirmed the views expressed by Koteswaram. A joint venture of Indian and Russia meteorologists carried out oceanographic and atmospheric studies with the help of modern techniques and instruments. They studied the irregularity of monsoon rainfall in summer season, and determined that Tibet Highland plays a dominant role in the origin of monsoon circulation over the Indian sub-continent. If the north-east winds are slow and weak, South-west monsoon also becomes weak otherwise not. More heating of Tibet Plateau makes monsoon more active. This plateau functions as a switch.

Flohn explained Tropical Jet Stream in 1968. According to him, Tibet Plateau is a steam engine for the origin of summer monsoon. It makes changes in the direction of winter winds, and thus, invites south west monsoon. At the time of south-west monsoon, the extension of tropical jet stream occupies more than half of the area of the northern hemisphere and thus, encourage heavy rainfall. The structure of Eastern

Jet Stream is an important and incomparable structure of north hemisphere, which provides power and strength to rain providing winds.

Fig. 4.5: Jet stream (After Pedelaborde).



Raman and Ramnathan highlighted on the structure of Tropical Easterly Jet Stream and suggested that Eastern Jet Stream becomes very active in the upper troposphere after the beginning of rainy season. The latent heat produced due to cloud cover results into inversion of temperature and causes rainfall.

S.Ram Rattan was of the opinion that the development of Monsoon winds is deeply connected with the air circulation in upper atmosphere in addition to the differential heating of land and sea. The air circulation is called Jet Stream. Jet Stream winds are sharp speed winds blowing in the upper limit of troposphere. This circulation creates anti-cyclonic pattern between 20oS and 40oN latitudes in summer, whereas cyclonic monsoon winds prevail at the surface. The upper atmospheric cyclone activates westerly jet winds in north of Himalayas while easterly jet winds in the south of Himalayas. These easterlies jet becomes powerful near 15o N latitude. This situation makes monsoon more active and thus, compel them for heavy rains.

A. Parthasarthy wrote an essay on 'Trying to solve the Monsoon Riddle' and explained that the monsoons are influenced by the north-east trade winds. Weak north-east trade winds result in the weak monsoon, and thus lead to drought conditions.

Thus it is revealed that the origin of monsoons does not depend only land and sea thermal contrasts but it is also affected by the circulation of upper air.

4.3.2 CLIMATE REGIONS OF INDIA

India is a so vast country that, it is quite natural to note here large variations in climate. The variation in height from mean sea level has given diversity to the climate. The climatic elements temperature and rainfall provide the base to divide India into climatic regions. Amount and variation of rainfall are much marked than those to temperature. Hence, most of scholars have given more importance than to temperature. The first attempt to divide India into climatic regions was made by Blanford. He said that the different parts of India exhibit a great diversity. Among the subsequent attempts to divide into climatic regions, the scholars who have forwarded their views on this issue are Stamp, Kendrew, Thornthwaite, Koppen, Trewartha and Johnson. A number of Indian scholars have also made attempts in this direction. Among them Subrahamanyam, K.S. Ahmad, R.L. Singh are worth mentioning.

4.3.3 STAMPS CLIMATIC REGIONS

The views of L. Dudley Stamp are identical to that suggested by Kendrew. They divided India into two main regions by Tropic of Cancer. This line more or less follows 180C isotherm of mean monthly temperature of January. The northern part of this line is defined as Temperate India and the southern part is defined as Tropical India. These two main climatic regions are further divided into eleven regions depending upon the amount of rainfall and temperature. This classification is quite rational and subjective.

Temperate India- It is also called continental India. This does not experience the temperature of January month more than 18oC. It is sub-divided in five regions on the basis of amount of rainfall and physiography

(1) Himalayan Region- It extends from Kashmir in west to Arunachal Pradesh in east. It includes Jammu & Kashmir, Himachal Pradesh, large part of Uttarakhand, Sikkim and Arunachal Pradesh. The summer and winter temperatures remain between 13oC to 18oC in June and 4oC to 7oC in January respectively. The temperature in some western parts goes down to freezing point in winter. The amount of rainfall is 200 cms. The eastern part receives the rainfall from Bay of Bengal Monsoon. The western part receives the rainfall mainly from Arabian Sea Monsoon and in winter from temperate cyclones. Shimla in the west and Darjeeling in the east are its representative cities.

(2) North-West Region- It extends on the region Sutlej and Beas Rivers, and enjoys dry conditions. It covers north Punjab and South Jammu & Kashmir. It receives rainfall in summer as well as in winter. The average annual rainfall is 38 cms. Rains are mostly received by temperate cyclones. The average temperature of January is 16oC and of June is 24oC. Amritsar is its representative city.

(3) Dry Desert Region- It includes most part of Rajasthan, North Gujarat, South Punjab, Haryana and Delhi. The average amount of rainfall is less than 25 cms. In western part, it goes down to 13 cm. The January temperature is between 13oC and 24oC, while the average temperature of July remains nearly 43oC. Jaipur is the representative city.

(4) Moderate Rainfall Region- It includes western and central part of Uttar Pradesh, North Madhya Pradesh and some parts of east Rajasthan. The temperatures of January month remain between 13oC and 24oC and July temperatures between 33oC and 35oC. It experiences warm air in May-June months, locally known as 'Loo'. These help in the increase of temperature. The average amount of rainfall remains 38 to 76 cm. Most of the rainfall is received in summer season. A little amount of rainfall is received by temperate cyclones in winter season. Delhi is the representative city.

(5) The Transitional Region- It is extended on east part of Uttar Pradesh and Bihar. The temperature of July is 320C to 350C and of January is 15oC to 19oC. The average annual rainfall is 100-150 cm. It receives rainfall from Bay of Bengal Monsoon winds.

(B) Tropical India- It is extended in the south of Tropic of cancer. The temperature of January month remains more than 18oC. This isotherm line does not fully follow the Tropic of Cancer line. It is sub divided into six sub division.

(6) Very Heavy Rainfall Region- It includes Meghalaya, Assam, Tripura, Mizoram, Nagaland and Manipur. The average annual rainfall is more than 200 cms. This rainfall is received in between April and September from Bay of Bengal Monsoon. Temperatures remain around 32oC to 35oC in July and reaches to 18oC in January. Cherrapunji is situated here and receives 1080 cms annual rainfall.

(7) Heavy Rainfall Region- It includes Chhatisgarh, Jharkhand, West Bengal, Odisha, East Maharastra and north-east Andhra Pradesh. July temperatures remain around 29oC to 35oC and in January around 18oC to 24oC. The average annual rainfall is 100 to 200 cms. The rainfall is received from Bay of Bengal Monsoon and also from tropical cyclones. These cyclones frequently come before and onset of Monsoon. Kolkata is the representative city.

(8) Moderate Rainfall Region- It includes Gujarat, South-West Madhya Pradesh, Central Maharashtra, East Karnataka, and West Andhra Pradesh. It receives rainfall on an average of 76 cm., which is quite low, and thus, is defined as Rain Shadow Area. Rains are brought by Arabian Sea Monsoon. The temperatures of January are 18oC to 24oC. May temperatures remain near 32oC. It has not much variation in temperature. Hyderabad is the representative city.

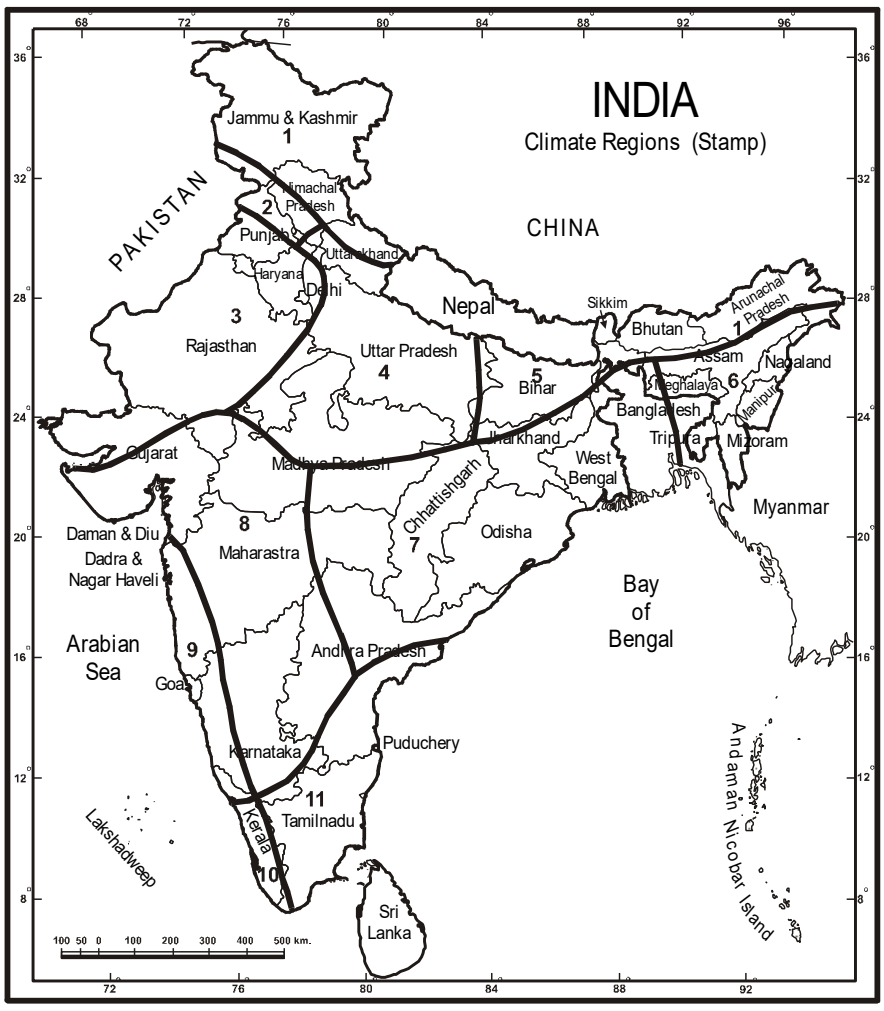
(9) The Konkan Coast Region- It extends from Narmada River in the north to a little north part of Kerala. The average amount of rainfall is more than 200 cms. It is provided by Arabian Sea branch. The annual range of temperature is very low. The average annual temperature is 24oC. Dry months are seven in number. Mumbai in the representative city.

(10) The Malabar Coast Region- It covers most of Kerala State and also includes Kanyakumari district of Tamilnadu. Dry season is only for three months. The average annual rainfall is more than 300 cm. The average temperature is 21oC. Thiruvanthpuram is the representative city.

(11) The Coastal Region of Tamilnadu-It includes most part of Tamilnadu, south-east Andhra Pradesh. The rainfall varies from 100 to 150 cm and is mainly received by the retreating monsoons in November and December. The temperatures remain from 240C to 270C. Chennai is the representative city.

The above classification is accepted by most of Indian Geographers. It is most easy to understand.

Fig. 4.6: Climate regions: Stamp.



4.3.4 CLIMATIC REGIONS ACCORDING THORNTHWAITE

This American Scholar presented his classification of climatic regions of India on the basis of following four bases-

(i) Seasonal distribution of rainfall,

(ii) Effect of temperature,

(iii) Precipitation effectiveness,

(iv) Use of English words.

He was of the opinion that the plant growth depends upon precipitation and as well as on its effectiveness. The precipitation effectiveness is determined by dividing total monthly precipitation by evaporation and is called the P/E ratio. He also examined soil, drainage and vegetation and determined the effect of precipitation on the growth of plants. He recognized eleven climatic regions of India which can be summarized as-

(i) AA'r- It is tropical wet climate. Rainfall occurs in all the seasons. It has dense evergreen vegetation. It is found in Mizoram, Meghalaya and Tripura.

(ii) BA'w- It is tropical humid climate. Rainfall is deficient in winter. It is found on eastern slopes of Western Ghats, and in West Bengal.

(iii) BB'w- It is temperate humid climate. Rainfall is less in winter; Assam, Meghalaya and Nagaland enjoy it.

(iv) CA'w- Sub-humid tropical climate, deficient in winter rainfall, climate suitable for grasslands only. It covers large parts of the Peninsular India.

(v) CB'w- Sub-humid sub-temperate climate. Deficiency in winter rainfall. It covers most parts of the Great Plains.

(vi) DA'w- Tropical semi-desert climate. Deficiency of rainfall in summer season. Suitable for steppe vegetation. It covers Gujarat and some parts of Rajasthan.

(vii) DB'w- Semi-dry desert climate. It covers western Punjab and Haryana.

(viii) DB'D- Semi-dry desert climate. Rainfall deficiency in all months. It covers rain shadow area of the peninsula.

(ix) D'- Cold climate- It covers eastern Himalaya, Uttrakahand, Northern parts of Punjab and Haryana.

(x) E'- Cold climate- It is found in higher altitudes of Himalayas and Laddakh.

(xi) EA'D- Tropical desert climate. Rainfall deficiency throughout the year, desert vegetation. It covers western part of Rajasthan.

This classification is quite complex, as India enjoys the climate of Equatorial areas to Polar areas.

4.3.5 CLIMATIC REGIONS ACCORDING TO KOPPEN

Dr. Vladimir Koppen of Austria divided India into three climate Regions in 1918- (i) Dry India (ii) Semi-dry India and (iii) Humid India. After some time he presented a new scheme of climatic classification in 1936. This classification is based upon the following four points:

(i) Annual and monthly average temperature

(ii) Amount of rainfall,

(iii) Local natural vegetation,

(iv) Use of English alphabets- i.e. A- for tropical rainy, B- for dry, C- for middle, latitude rainy climate with mild winters, D- for middle latitude climate with sever winters, E- for polar climate. For further sub-division small letters a, c, f, w, s, g, are used.

Koppen has put India into nine climatic regions

1. Amw- (Monsoon type with short dry winter season)- This is found in Western coastal plain. It receives more than 200 cm rainfall in summer, winters are dry. It has tropical evergreen forest.

2. AW- (Tropical Savannah type) - This climate is found in most parts of peninsula. Rainfall occurs in summer season, winters are dry. Summers are quite warm. The average annual rainfall is 75 cms.

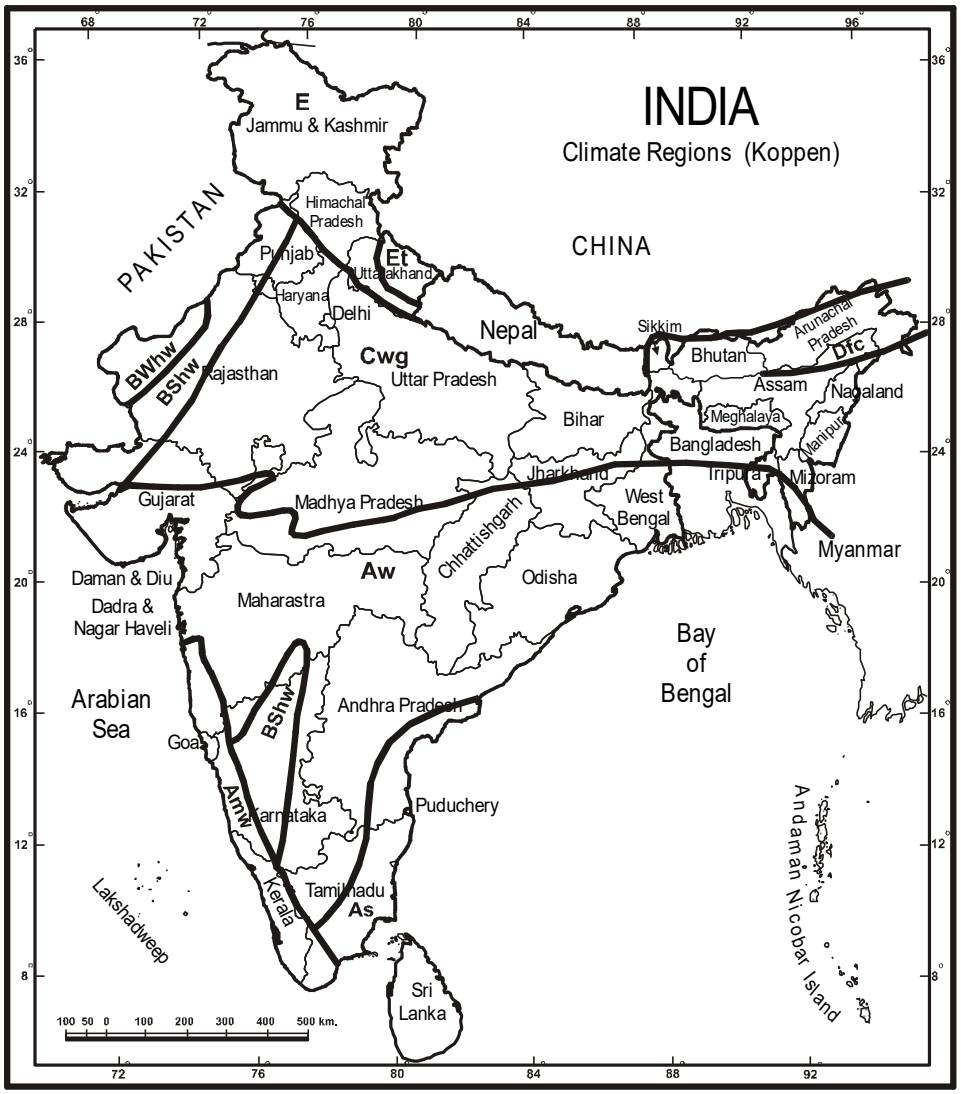
3. AS- (Monsoon type with dry season) - This region receives its most of the rainfall in winter season from the retreating monsoon. It covers south-eastern coastal plains. Summer is dry.

4. BShw- (Semi arid steppe type)- It occupies Rajasthan, Karnataka and parts of Haryana and Gujarat. Rainfall occurs in summer but in little amount. Winters are completely dry. The average annual temperature is 18oC.

5. BWhw- (Hot desert type)- The western part of the desert enjoys suchclimate. The annual rainfall is less than 12 cms. Temperatures are very high is summer.

6. Dfc- (Temperate wet climate) - It is cold with humid winters summers are very short but rainy. It covers Arunachal Pradesh, Assam and Sikkim. The temperature in winters is recorded near to 100C.

Fig. 4.7: Climatic regions: Koppen.



7. Cwg- (Monsoon type climate)- This type of climate is found in most parts of the Great Plains, east Rajasthan, north Madhya Pradesh, north Jharkhand. The summers are very hot but with rainy seasons. Winters are dry.

8. E- (Polar type) - It is extended on Jammu & Kashmir andHimachalPradesh. The temperature of the warmest month remains less than10º C.

9. Et- (Tundra type) - This is found in north part of Uttarakhand.Summers are cold with temperature from 0ºC to 10ºC. The temperaturedecreases with the increase in altitude.

Criticism- According to Koppen, India entertains all type of climate i.e., from Tundra type to tropical wet type. He has not accepted the climatic difference of Upper Ganga Plain. He has also put eastern Maharastra and coastal region of West Bengal into one type of climate.

4.3.6 CLIMATIC REGIONS ACCORDING TO TREWARTHA

This American Geographer has forwarded his views on the climate of India in his book, "An introduction to Climate". He has modified and simplified Koppen's scheme. His classification is an easy and rational. He has used the English word A, B, C and H and put India into seven types of climatic regions. He used A for tropical humid, B for dry, C for sub-tropical and H for mountain climate. Thus, India has A, Am, Aw, Bs, Bsn, Bwh, Caw and H type of climatic regions.

4.3.7 CLIMATIC REGIONS ACCORDING TO R.L. SINGH

R.L. Singh presented his climatic divisions of India in 1971 in his book 'India: A Regional Geography' His scheme is forwarded with certain modifications in the divisions of Kendrew and Stamp. His classification is based on the temperatures of hottest and coldest months and an amount of annual rainfall. This classification is easy, explanatory and rational. It explains ten climatic regions of India:

1. Per Humid North-East- It covers nearly all north eastern states Sikkim, Meghalaya, Mizoram, Assam, Arunachal Pradesh, Nagaland and Darjeeling Himalaya of West Bengal. The warmest month is July with 25oC to 33oC temperature. The temperature of coldest month January is 11oC to 24oC. The average annual rainfall is more than 200 cms.

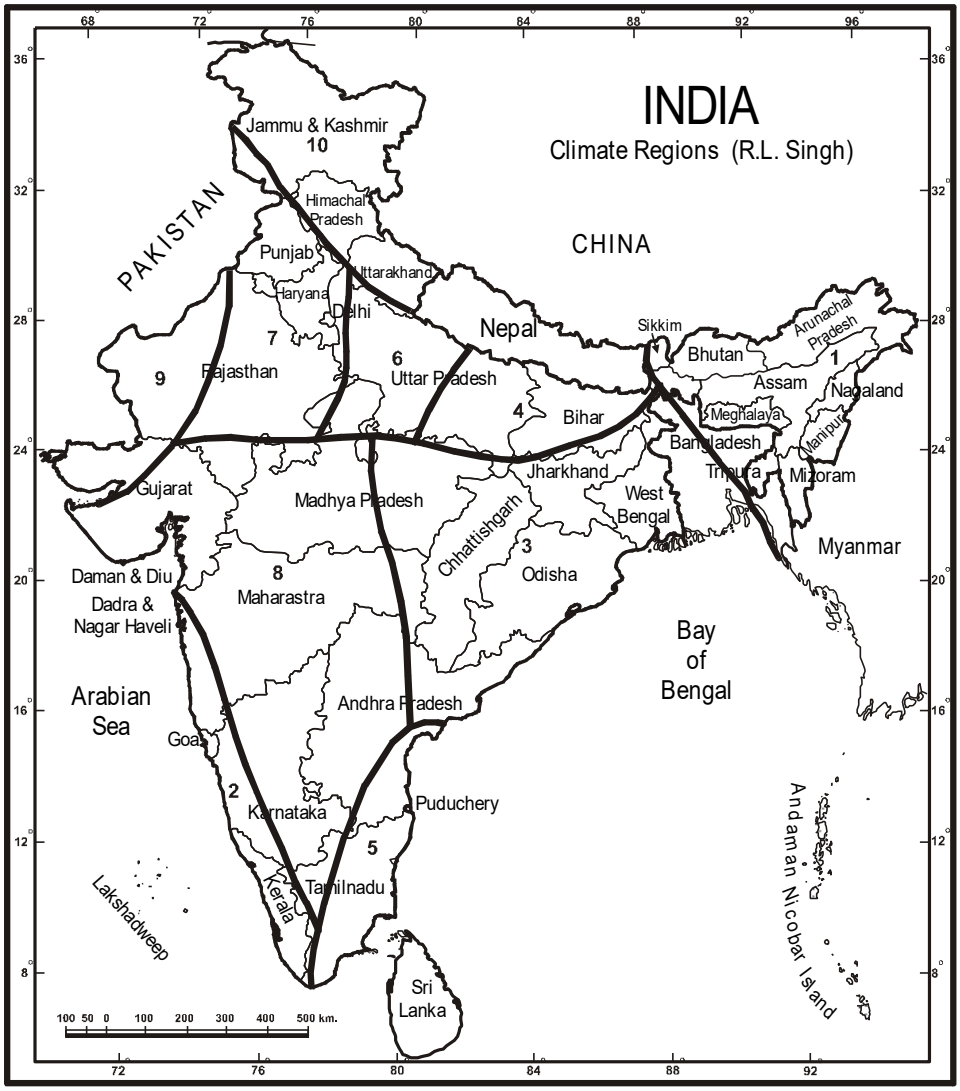
2. Humid Sahyadri and West Coast- It is extended on West coastal region from the south of Narmda River to Kanyakumari. It also includes the western slopes of the Sahyadri. July is the hottest month with 260C to 320C temperature. The month of January has the temperatures from 180C to 280C. The average annual rainfall is more than 200 cms.

3. Humid South-East- It covers Chhattisgarh, Odisha, Jharkhand, West Bengal and north-east part of Andhra Pradesh. The hottest month is July with temperatures from 26oC to 34oC and January is the coldest month with 12oC to 27oC temperature. The annual average rainfall is 100-200 cms.

4. Sub-humid Transition- It is extended on middle Ganga Plain covering east Uttar Pradesh and Bihar. July is the hottest month with 240C to 410C and January is the coldest month with 90C to 240C temperature. The average annual rainfall is 100-200 cms.

5. Sub-Humid Littorals- East Tamilnadu and Coastal region of Andhra Pradesh enjoy such climate. May is the hottest month with 28oC to 33oC temperatures. January is the coldest month with 20oC to 29oC temperatures. It means that the temperature never goes below to 20oC. The area as a whole receives 75-150cms. annual rainfall, most of which is received from retreating monsoon in November December.

Fig. 4.8: Climatic regions: R.L. Singh.



6. Sub-humid Continental- It covers Upper Ganga Plain. July with 26oC to 33oC temperature is the hottest month, while January with 7oC to 23oC is the coldest month. It shows high difference in the temperatures of summer and winter seasons. The annual average of rainfall is 75-150 cms.

7. Semi-Arid Sub-Tropical- It is extended on Sutlej-Yamuna divide and thus includes Punjab, Haryana, central east Rajasthan, Chandigarh and Delhi. May becomes very hot, and the temperatures remain from 26oC to 41oC. January has the

temperature from 6oC to 23oC. The average of rainfall is 25-100 cms. Some rainfall in winter is caused by western disturbances.

8. Semi-Arid Tropical- Large parts of Gujarat, Maharastra, Madhya Pradesh, Chhatisgarh, Karnataka and Western Andhra Pradesh have such type of climate. July is the hottest month with 26oC to 34oC temperature. The temperature of January month is 130C to 210C. The average of rainfall is 50 to 100 cm.

9. Arid- This most dry part is extended on Thar Desert, Rann of Kutch, South west Haryana. It is the hottest part of India, and also has high range of temperature. Thus, there is a high difference in temperatures of summer and winter seasons. June has the temperature 28oC to 45oC and January temperatures are 6oC to 23oC. The rainfall is less than 25 cms.

10. West-Himalayan- Jammu-Kashmir, Himachal Pradesh and Uttrakhand are included in it. July has the high temperatures from 5oC to 30oC. January temperatures are very low and sometimes reach near to freezing point. The temperature is 0oC to 4oC. The average of rainfall is 150 cm, mainly received from western disturbances. It also receives a little amount of rainfall from monsoon winds.

4.4 SUMMARY

The climate of India is known as 'Tropical Monsoon climate'. It has the influence of a number of factors such as its locational extent, in both the zones, changing nature of monsoon winds, the circulation of the air in the upper layer of troposphere, and the extent of Himalayan mountain range. All these factors, though have given India one type of climate, but there are remarkable diversities in its climate due to its vastness. Indian climate has two contrast seasons, designed by south- west winds in summer and north-east winds in winter. Indian climate is also influenced by these factors which take place beyond its limits.

Areas in the south of Tropic of Cancer have tropical climate whereas the areas in the north of this line experience semi temperate climate. Himalaya protects it from the effect of polar winds. Coastal areas have mild climate. Physiography leaves its effect on temperature, air pressure, direction of winds and the amount of rainfall. Altitude variations leave its effect on temperature. El-Nino current, a warm current affects the monsoon. La-Nina current makes monsoon showers strong. The temperature variations of Indian and Pacific Ocean have their effect on the monsoon rainy winds. The low pressure in Pacific Ocean is conductive to weak monsoon rainfall. Tropical cyclones in the onset and offset of monsoon seasons and western disturbances in the winter season also affect the climate.

The term Monsoon means season. Monsoon winds are seasonal winds on large scale. Sometimes, it is known for rainy winds. Most of the scholars accept it as double

system of winds. Three theories have been proposed on its origin. The classical concept is based on the contrast in land and sea temperatures. The air mass concept is based on the convergence of two winds of different nature at the point known as inter-tropical front. This inter tropical convergence shifts its position according to seasons. The Jet stream is a recent concept. Jet streams are upper air circulation winds. These winds make the monsoon active in India. It forces monsoon winds by putting pressure on the surface winds. They increase or decrease the monsoon rain and also make the distribution uneven. Various scholars have defined jet stream and its impact on monsoon rain in their own way.

Most of the scholars have divided India into climatic regions on the basis of temperature and amount of rainfall. Stamp has divided India into two main regions on the basis of Tropic of Cancer, which follow the isotherm of 18oC. Both these regions i.e. temperate India and tropical India have been put into 11 sub divisions on the basis of physiography and rainfall. Koppen, Trewartha and Thornthwaite have also classified India into climatic divisions. R.L. Singh has put the scheme with certain modifications in the divisions of Kendrew and stamp. He has divided India into ten climatic regions taking into consideration, the temperature of hottest and coldest months and an amount of annual rainfall.

4.5GLOSSARY

- Equable climate - No change in climate throughout the Year.
- El-Nino - Warm ocean current.
- Himalaya - Acts as Meteorological barrier.
- Inter-tropical Convergence - Zone of low pressure.
- Jet Stream - Upper circulation winds, flow at a height of 8 to10 kms.
- La-Nina - Cold water current.
- Monsoon - Seasons, seasonal winds, south-west& North-East.
- Perturbation - New concept of monsoon.
- Precipitation - Total humidity obtained by the surface.
- Tropical cyclone - Bay of Bengal and Arabian Sea cyclones.
- Western disturbances - Temperate cyclones.

4.6 ANSWERS TO CHECK YOUR PROGRESS

1. The main components of environment are climate, soil and natural vegetation.

2. India enjoys Tropical Monsoon climate.

3. India has climatic diversities due to its vastness.

4. South-west winds blow in summer.

5. North-east winds blow in winter.

6. Nearly half part of India lies in the north of Tropic of Cancer i.e. in temperate zone but enjoys sub-tropical climate due to Himalayas in the north.

7. Coastal areas have equable climate

8. Aravalli Hills are not capable to obstruct monsoon winds.

9. High attitude areas in peninsular area have cooler climate.

10. Monsoon winds are seasonal winds.

11. El-Nino is a warm current.

12. Jet streams are upper circulation winds.

13. Tibet plateau functions as a steam engine.

14. El-Nino current affects the temperature of Indian Ocean.

15. La Nina is just opposite to El-Nino as it is a cold current.

16. High and low pressure over the pacific and Indian ocean is called southern oscillation.

17. Tropical cyclones mostly originate in Bay of Bengal.

18. Tropical cyclones affect the climate of coastal and its nearby areas.

19. Western disturbances are temperate cyclones.

20. Western disturbances provide rainfall in winter season mainly to north-west India.

21. Monsoon means season.

22. The classical concept of origin of Monsoon is based on thermal contrast in land and sea.

23. Monsoon is a seasonal migration of planetary winds.

24. Inter-tropical convergence is a meeting point of land and sea winds.

25. ITC is really a zone of low pressure.

26. Jet Stream is a recent concept.

27. Perturbation school is a recent concept.

28. Jet Stream also affects the amount and distribution of monsoon rainfall in India.

29. Koteswaram and M.T. Yin have forwarded their views on the Jet stream concept.

30. Large variation in the climate is responsible for climatic regions.

31. Stamp has divided India into two main climatic regions on the basis of 18oC isotherm.

32. Stamp has given sub-division on the basis of rainfall.

33. Stamp has divided India into 11 climatic regions.

34. Thornthwaite's classification is based on precipitation effectiveness.

35. Thorthwaite classification is quite complex.

36. Koppen's classification is based on amount of rainfall and monthly and annual average temperature.

37. Trewartha has simplified Koppen's scheme.

38. R.L. Singh in his book India: A Regional Geography has given a map on climatic regions of India.

39. Singh classification is based on rainfall, temperatures of hottest and oldest months.

4.7 REFERENCES

1. Das, P.K. (1968), The Monsoons: NBT, New Delhi.

2. ICAR (1980), Handbook of Agriculture, New Delhi.

3. India (2015), A reference Annual, publication Division GOI, New Delhi.

4. Katiyar, V.S. (1990): The Indian Monsoon and its frontiers, Inter India Publications, New Delhi.

5. Law, B.C. (1968), Mountains and Rivers of India, National committee for Geog. Calcutta.

6. Pedelaborde, O. (1963), The Monsoon, Methuen & Co. Ltd. London.

7. Negi, S.S. (1990), Forest types of India, PEBA, New Delhi.

8. Trewartha, G.T. (1959), An introduction to climate, MC, Graw Hill Book Co. New York.

4.8 TERMINAL QUESTIONS

A-Long Questions

1. What do you mean by Monsoon? Discuss its various meanings.

2. Give brief analysis of theories on the origin of Monsoon.

3. Discuss the Jet Stream Theory of Monsoon.

4. Discuss those external factors, which affect on the origin of Monsoon.

5. Discuss those factors which influence the climate of India.

6. India is known as a Tropical Monsoon Climate country, inspite of that, it has a lot of climatic variations. Analyze it.

7. Divide India into climatic regions and discuss the basis of your classification.

8. Examine the views of various scholars given on the climatic regions of India.

9. The division of India into climatic regions made by R.L. Singh presents a correct and clear picture. How do you agree with this statement? Discuss.

B- Short Questions

1. Which two factors mostly affect the climate of India?

2. Physiography is the most determining factor of Indian climate. Explain.

3. How the location has affected Indian climate? Explain.

4. Discuss the El-Nino affect on the climate.

5. Discuss the effect of western disturbances on India climate.

6. Tropical cyclones are more disastrous in coastal areas than the inner area. Discuss

7. What do you mean by term Monsoon?

8. Monsoon is a dual system of winds. Justify it.

9. Discuss the main definitions of Monsoon.

10. Discuss the classical concept on the origin of Monsoon.

11. Air mass school is based on the location of Inter-tropical convergence. Justify it.

12. Explain the perturbation school of monsoon origin.

13. Define Jet Stream and explain its effect on Indian Monsoon.

14. Differentiate between El-Nino and La-Nino ocean currents.

15. What do you mean by southern oscillations?

16. Discuss the main characteristics of Jet Stream

17. Give your comment on the views of scholars on Jet Stream.

18. Discuss the views of Koteswaram on Jet Stream.

19. Discuss the climatic regions of India forwarded by Dudley Stamp.

20. Explain climatic regions according to Thornthwaite.

21. How Koppen has divided India into climatic regions. Explain.

22. Discuss climatic regions forwarded by R.L. Singh.

C- Objective type questions

1. Which of the following factor is most important affect the climate of India-

(a) Location and latitudinal extent (b) Distance from the sea

(c) Altitude (d) Southern oscillation

2. Physiography of India do not have its influence on which of the climatic factor-

(a) Temperature (b) Atmospheric pressure

(c) Amount of rainfall (d) Tropical cyclones

3. Monsoon winds are-

(a) Rainy winds (b) Seasonal winds

(c) Warm winds (d) Cold winds

4. El-Nino is what type of-

(a) Cold current (b) Counter current

(c) Warm current (d) Polar current

5. Which of the following characteristic is not of tropical cyclones-

(a) Originate in Bay of Bengal

(b) Originate in Arabian Sea

(c) Frequency more before the monsoon

(d) Frequency more in winter season

6. Monsoon rains have not the affect of which of the following factor-

(a) Jet stream (b) El- Nino

(c) Tibbetean plateau (d) Polar winds

7. Jet Stream are winds of-

(a) Upper troposphere winds (b) South-east trade winds

(c) North-east trade winds (d) Mediterranean winds

8. Which of the following scholar has not forwarded his views on perturbation school-

(a) Koteswaram (b) M.T. Yin

(c) H.G. Dobby (d) Flohn

9. The views of which foreign scholar are more significant in the determination of climatic regions of India-

(a) Trewartha (b) Thornthwaite

(c) Koppen (d) Dudley stamp

10. R.L. Singh in his classification of Indian climate, which factor has not taken into consideration-

(a) Temperature of hottest month

(b) Precipitation effectiveness

(c) An amount of annual rainfall

(d) Temperature of coldest month

Answer

1 (a), 2 (d), 3 (b), 4 (c), 5 (d), 6 (d), 7 (a), 8 (c), 9 (d), 10 (b),

UNIT 5 – SOILS AND NATURAL VEGETATION

5.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Information about classification and types of soils in India.
- Know about soil erosion and its conservation in India.
- Understand floristic regions, types of natural vegetation and their distribution in India.
- Know about National Forest Policy and Wild Life in India.

5.2 INTRODUCTION

Soil is a valuable natural resource, On which the entire agricultural production depends, from which human food and important raw materials are obtained. Soil is actually the core of the biosphere. Because it is core part of the circle in which plant nutrients are produced and maintained and these nutrients are accessible to plants through their roots and micro-organisms also obtain these nutrients for their sustenance. The loose and unorganized earth materials produced by disintegration and decomposition of rocks are called soil. According to **J. S. Joffe** (1949), “Soils are natural objects made up of animal, mineral and organic matter, in which there are different layers of different thickness. These layers of soil, in terms of morphology, physical and chemical composition and biological characteristics are separated from the substances below.” According to American soil expert **Dr. Bennett**, "Soil is the upper layer of organized substances found on the earth's surface which is formed by the combination of original rocks or vegetation. It is formed by climate and fragmentation of rocks. "Soil is extremely valuable to human beings as a natural asset. The history of human civilization begins with soil. The birth place of ancient civilization has been the Indus Valley with fertile soil. If the soil of a country is fertile, then it is capable of supporting a rich agricultural economy and economic population, on the contrary, the economy of a country with less deep and infertile soil is depressing, both the density of population and the standard of living in such an area are low.

Natural vegetation is such trees and plants, which grow and grow on their own without the effort of man. Most of the plants growing in forests, seas and deserted places are examples of this. It is also called virgin plant. The word ‘Forest’, is being derived from the Latin word 'Foris', which means outside. Initially, this word was used to determine the boundary of the village. The meaning of the word forest is narrow, which is used for such a large area, in which dense cover

of trees and shrubs is found. Currently, there is no clear nationally-accepted definition of 'forest' in India. It is the responsibility of the states to determine the definition of forests. Forests have been included in the Concurrent List (Seventh Schedule) of the Constitution of India. The protection of forests and wild animals and birds was transferred from the State to the Concurrent List through the 42nd Amendment Act, 1976. Article 51A(g) of the Constitution states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and wildlife. Article 48A in the Directive Principles of State Policy mandates that the State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country. According to botanists, the vegetation of India can be divided into two parts – (1) Indigenous or Endemic - It includes 60% of the country's vegetation, whose distribution is found in the Himalayas and peninsular regions. (2) Exotic - Its spread is found in the Ganga plain and desert parts. It has come from Tibet in India, Africa (in Thar region), Malaya etc. About 30,000 plant species are found in India, which are included in 10 plant families. Of these, two belong to the temperate group and the remaining eight belong to the tropical group.

5.3 SOILS AND NATURALVEGETATION

5.3.1 CLASSIFICATION OF INDIAN SOIL

Classification of Indian soil has been done by many Indian and foreign scholars in the last many years. First of all, in 1879, Dok Shaiv classified the soil and divided the soil into normal and abnormal soil. On the basis of empirical classification, four types of soils - Alluvial, Regarh, Red and Laterite were identified in India by Voelekder in 1893 and Leather in 1898. In 1932 Z. J. Shokalskaya divided the soils of India into 16 parts on the basis of Russian soil science. In 1953, D.N. Wadia divided the country's soils into 6 parts on geological basis - Red, Black or Regarh, Laterite, Alluvial, Alkaline and Mountain-forest soil. After this, in 1957, the National Atlas Organisation, Kolkata divided the country's soils into six major – Alluvial, Trappian/Lava, Aryan and Cambrian, Mountainous, Desert and Coastal and 11 minor parts. In 1963, the Indian Council of Agricultural Research (ICAR) divided the country's soils into seven main - Alluvial, Peat, Red, Laterite, Black, Desert & Mountain and sub-regions by Ray Chaudhary. The Soil Survey of India was established in 1956. It studied Indian soil in some areas in detail. The Indian Council of Agricultural Research and the National Bureau of Soil Survey

and Land Use Planning also conducted detailed research. Finally, the Indian Council of Agricultural Research classified Indian soil into 8 major and 27 minor divisions. These eight major soil groups include (1) Alluvial, (2) Red, (3) Black, (4) Laterite, (5) Desert, (6) Mountain, (7) Forest and (8) Peat soil.

Table 5.1 - India: Types of Soils

S.No.	Soil types	Area (Million Hectares)	Percentage
1.	Alluvial soils	101.2	
2.	Deltaic Alluvium, sometimes saline	17.0	
3.	Alluvial soils, highly calcareous	8.9	
4.	Coastal alluvium	8.5	
5.	Alluvial soils (affected by salinity and alkalinity)	6.9	
	Alluvial soils (Total)	**142.5**	**43.4**
6.	Red soils	3.1	
7.	Red gravelly soils	1.6	
8.	Red and Yellow soils	17.8	
9.	Mixed Red and Black soils	10.5	
	Red soils (Total)	**61.0**	**18.6**
10.	Medium Black soils	18.6	
11.	Deep Black soils	6.9	
12.	Shallow Black soils	4.9	
13.	Black soils (affected by salinity and alkalinity)	6.9	
14.	Black soils (unclassified)	12.5	
	Black soils (Total)	**49.8**	**15.2**
15.	Laterite	10.1	
16.	Laterite and Laterity soils	2.1	
	Laterity soils (Total)	**12.2**	**3.7**
17.	Desert soils	14.6	
18.	Mountain and Grassland soils	11.7	

19.	Mountain soils (unclassified)	6.5	
20.	Foothills and Tarai soils	5.7	
21.	Forest soils (Laterite)	6.5	
22.	Podzolic soils	3.6	
23.	Hill soils	2.4	
24.	Gray and Brown soils	3.6	
25.	Brown soils (under deciduous forests)	1.6	
26.	Skeleton soils	2.4	
27.	Peat, Mud and Humose soils	0.2	
	Other soils (Total)	**58.8**	**17.9**
	Snow and Glacier covered areas	4.0	1.2
	Total Reported Area	**328.3**	**100.0**

Source: S.P. Chatterjee, 1973 & 1986

Alluvial Soils

Alluvial soil is also known as Loam and Kachhar soil. The soil brought by the rivers is called alluvial soil. These soils are formed from the sediment deposited by the rivers. The Alluvial soils covers an area of 14.25 lakh square kilometers (43.4%) of the country from the Sutlej river in the west to the Brahmaputra valley in the east. Apart from this, their expansion is also found in Narmada, Tapi, Mahanadi, Godavari, Krishna and Kaveri river valleys. With the support of Kerala, they are called coastal alluvium and in the delta region of Mahanadi, Godavari, Krishna and Kaveri, they are called deltaic alluvium. They have been formed by the debris received from the Himalayas and peninsular and the silt left by the diverging sea. Their color varies from light gray to ash gray and their texture varies from sandy to silty loam. It is renewed every year. The deltaic alluvium is very fine and fertile. The size of the alluvial soil varies from granular to very fine towards the delta at the bottom of the river valley. These soils are found at a depth of 500 meters to more than 1000 meters in the plains of river Ganga. They are very fertile, rich in nitrogen, humus, phosphoric acid, lime and organic matter, but they lack phosphates. Various types of crops can be grown on these like wheat, rice, sugarcane, jute, cotton, vegetables and oilseeds etc. These soils are suitable for irrigation.

Alluvial soil is of two types – Bangar or old alluvium and Khadar or new alluvial.

(A) Bangar or old alluvium - Their position is at some height beyond the reach of flood (Pleistocene platforms). Here the color of the soil is dark (yellow blood brown). In which bodies of calcareous pebbles are found more. At some places due to saline and alkaline eruptions deposits are seen in them due to which Usar areas have been formed. Regular fertilizers are required in Bangar soils. Here crops like rice and wheat are cultivated in the lower parts. it is less fertile than Khadar.

(B) Khadar or new alluvial - Its expansion is found in the flood plains of the river, where every year, during the flood, new layer of soil is deposited and the fertility of the soil remains. The color of this soil is light and lack of calcareous substances is found . The quantity of chica is more in these, due to which their ability to hold moisture is more. The use of fertilizers is less in these. Ravi crops are grown in these after the flood is over.

Alluvial wings are found in the foothills of Shivalik, whose soil is coarse and granular. Terai soil is rich in nitrogen and organic matter and deficient in phosphate. Wheat, sugarcane, oilseeds etc. are cultivated here after clearing the dense forests and tall grasses. The ancient alluvium found in the higher reaches here is known as Rarh. On the basis of transport factor, alluvial soil is divided into two subdivisions-

(A) Made by water - It can be subdivided into riverine, lake, coastal.

(B) Wind-formed – includes loess and sandy soils.

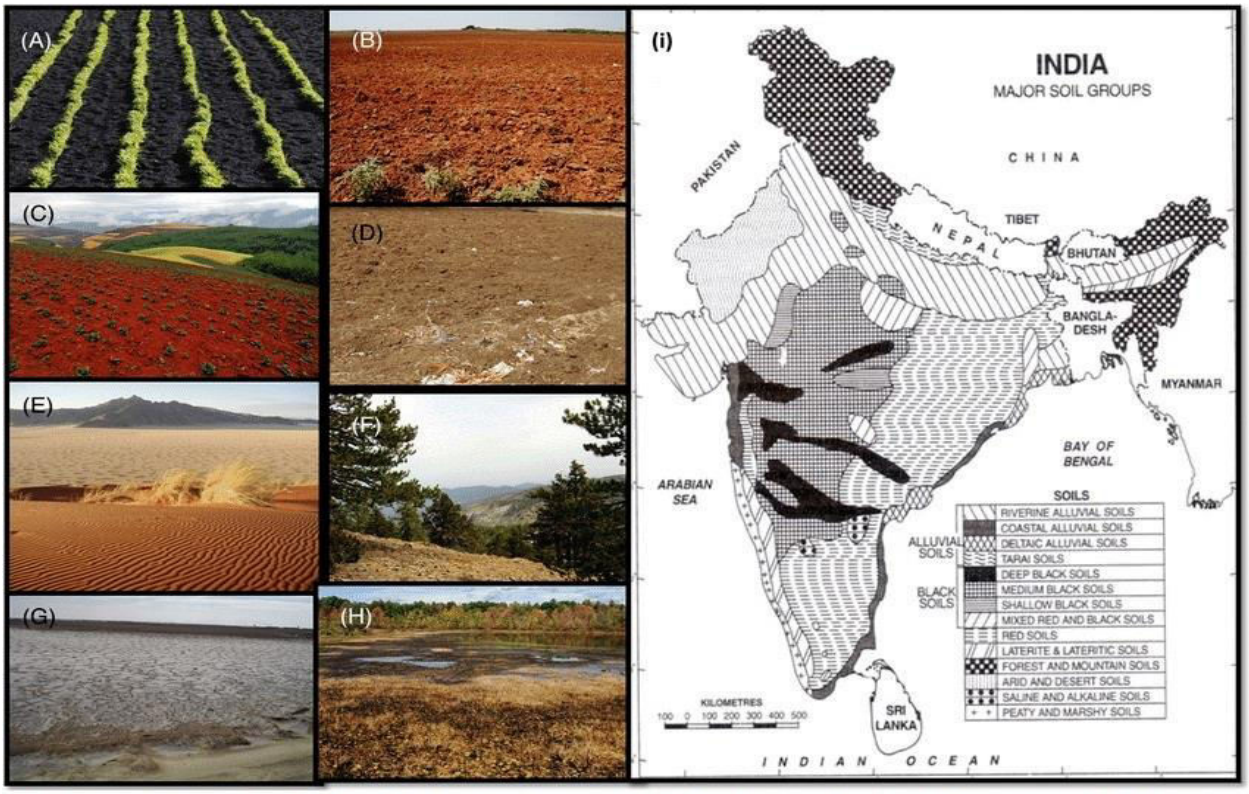
Red Soils

It is the second major soil group in the country, spread over an area of about 6.1 lakh square kilometers (18.6% of the country's area) in the peninsular region from Tamil Nadu in the south to Bundelkhand in the north and from Kutch in the west to the Raj Mahal Hills in the east. These soils surround the black soil in the south, east and north. Red soils have developed over ancient igneous, crystalline and metamorphic rocks in areas of low rainfall in the eastern and southern parts of the Deccan Plateau. It is formed in situ by the decomposition of rocks. A long stretch of these soils is also found at the base in the eastern part of the Western Ghats. Red soil is found in parts of Orissa and Chhattisgarh and in the southern parts of the middle Gangetic plain. The red color of the soil is due to the oxidation and rusting of iron in crystalline and

metamorphic rocks. It appears yellow when hydrated. Coarse-grained, friable red soils of low fertility are found in the dry uplands. The fine grained red and yellow soils in the lowlands and plains are generally fertile. Red soil is deficient in phosphorus, nitrogen, lime and humus. Crops can be cultivated with adequate use of fertilizers. These soils do not contain much moisture and are, therefore, suitable for dry farming techniques. Rice, wheat, sugarcane, cotton and pulses can be cultivated in these soils when they are well watered and fertilized. In their chemical composition, insoluble elements are 90.47%, iron 3.61%, aluminum 0.70%, lime 0.56%, carbon dioxide 0.30%, potash 0.24%, soda 0.12%, phosphorus 0.09%, and nitrogen 0.08%.

In 1941 Ray Chowdhary divided red soils, morphologically, into two parts red loamy soil and sandy red soil. The Indian Council of Agricultural Research (ICAR) has divided these into four types – red soil, red gravelly soil, red and yellow soil, and red and black soil.

Fig 5.1 Types of Soils



Different soils found in India: (A) black soil, (B) alluvial soil, (C) red soil, (D) laterite soil, (E) desert soil, (F) forest and mountain soil, (G) saline and alkaline soil, (H) peaty and marshy soil; and (I) their localizations

Source:https://www.researchgate.net/figure/Different-soils-found-in-India-A-black-soil-B-alluvial-soil-C-red-soil-D_fig2_313351187

Black Soils

These are known by the names Regarh, Tropical Black Earth and Tropical Chernogem etc. It is spread over an area of about 49.8 million hectares (15.2%) of the country. It is found in those areas where the annual rainfall is 50 cm to 75 cm and the number of rainy days is between 30 and 50. Black soils were formed due to the weathering of lava spread over in large areas of peninsular India. They were formed 70 million years ago during volcanic activity in the Deccan Plateau. These soils are also called black cotton soils, as cotton is the most important crop grown on these soils. These soils cover parts of Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Telangana and Tamil Nadu. This region covers a major part of the Deccan Plateau. The upper reaches of the Godavari and Krishna rivers and the north-west Deccan plateau are rich in black soil. Black soils contain high clay content, so they become sticky when wet and form deep cracks when dry. A sort of 'self-cultivation' takes place and the soil becomes aerated. This soil needs to be plowed after the first rains as plowing is difficult when wet and sticky. Calcium carbonate, magnesium carbonate, potash and lime are found in abundance in these. They are deficient in phosphoric acid, nitrogenous and organic matter. Black soils vary in color from dark black to brown because they are moisture-retentive and do not dry out easily. Hence they support crops in the dry season. Apart from cotton, wheat, sugarcane, tobacco and oilseeds are also grown in these soils. According to the tests done in Nagpur, the soluble fraction of this soil is 68.71%, ferric oxide 11.4%, alumina 9.39%, water and fossils 5.8%, lime 1.81% and magnesia 1.79%.

On the basis of proportion of clay and silt, there are two main types of black soils - (a) Trappian black clayey soil, its extension is found in most part of the peninsula. (B) Trappian black loamy soil, in this the quantity of silt is found to be 30% to 40%in it. It is found in small pieces in the area of Venganga valley and North Konkan coast. Depending on the thickness of the layers, they are divided into three parts, shallow (30 cm), medium (30 to 100 cm) and deep (more than 1 m). Similarly, on the basis of colour, they are divided into dark colored and light colored.

Laterite Soils

The first study of these soils was done by F. Buchanan in the year 1905. The word ‘laterite’ is derived from the Latin word 'brick'. Laterite soils have developed as a result of leaching (washing away soluble soil to lower layers) in areas of high temperature and heavy rainfall. Leaching reduces the proportion of lime and silica, while increasing the proportion of iron and aluminum compounds in the upper layers of the soil. The nature of this soil is acidic, rough and zigzag in texture. Oxidation of iron gives a red color to the soil. The amount of humus is removed by bacteria that grow well in high temperatures. Laterite soils are deficient in organic matter, nitrogen, phosphate and calcium; whereas iron oxide and potash are present in high quantity in these soils. Hence, laterites are not suitable for cultivation. However, some crops can be cultivated with the use of manure. Coffee, rubber, cashew and tapioca are some of the crops can be grown on the soil. Laterites are widely mined as bricks for use in house construction. They are found in Kerala, Karnataka, Tamil Nadu covering the Western Ghats, the hilly region of Orissa, Assam and Meghalaya, the Chotanagpur Plateau and the hill slopes of some parts of Madhya Pradesh.

Laterite soils are spread over an area of about 1.22 lakh square kilometers (3.7%) of the country. There is a general relationship between their chemical composition and height. The soils of the upper parts are more acidic than the lower parts. By chemical composition, it contains 32.62% silica, 25.28% aluminum, 18.7% iron, 0.42% lime and 0.07% phosphorus. On the size of the particles laterite soil is divided into three subdivisions groundwater laterite, deep red laterite and white laterite.

Mountain Soils

This soil is found in the valleys and slopes of the Himalayan region between an altitude of 2700 meters to 3000 meters. These soils are shallow and immature and have a wide range of carbon-nitrogen ratio. These silts are loamy to loamy in texture and dark brown in colour. It is slightly acidic to moderately acidic. These are divided into loamy podzol and high local sections. Podzols are found in Assam, Darjeeling, Uttarakhand, Himachal Pradesh and Kashmir in areas of Cedar, Pine and Blue Pine at moderate altitudes. On the basis of forest cover, rocks, slope and rainfall, the soil of higher parts is divided into brown soil, red loam, rendjina and gley etc.

Desert Soils

It is spread over an area of about 1,42,000 square kilometers. It contains 0.03 to 0.13% nitrogen, 0.03% to 0.07% potash, 0.03% to 0.13% phosphorus, and 0.02 to 2.0% lime. Desert soils are divided into Rigosolic and Lithosolic classes. Desert soil is dry soil. Their color ranges from red to brown. These soils are sandy in composition, therefore porous and lack of moisture. They are of salty nature. Due to the absence of vegetation and the dry climatic conditions in which they grow, the percentage of organic matter is low. Since there is no rain to wash away or dissolve the salts, these soils are usually alkaline. Nitrogen is insufficient and phosphate is sufficient in desert soils. The lower horizon consists of a layer of pebbles because the lower layers have higher calcium content. Therefore, when this soil is irrigated, the soil moisture is available for plant growth. The desert soils are well developed in Rajasthan, northern Gujarat and southern Punjab. They cover four percent of the country's land area. With irrigation, it is possible to grow crops like cotton, gram, mustard, wheat, jowar, bajra, grapes, lemon and melon in these soils.

Forest Soils

These soils are found in the coniferous forest areas in the Himalayas between 3000 meters to 3100 meters. Some of their deposits are also seen in Sahyadri, Eastern Ghats and Terai region. Here the ground is covered by the leaves of trees and plants, due to their rotting, the color of the soil is black in the upper part which turns gray brown and gray red towards the bottom. Deficiency of potash, phosphorus and lime is found in these soils. Changes are seen from podzol in acidic directions to brown soil in slightly acidic or neutral conditions. Parts from tea, coffee, spices, wheat, rice, maize, barley etc. are produced.

Peaty and Marshy Soils

The continuous presence of water results marshy soils in areas of heavy rainfall and high humidity. Vegetation is abundant in such a climate, so it adds large amounts of decayed organic matter and humus to the top soil. This soil is dark colored and very heavy. They are found in northern part of Bihar, south Uttarakhand in Terai and coastal areas of Tamil Nadu, Orissa and West Bengal. Jute cultivation is ideally done in such type of soil.

Saline and Alkaline Soil

It is spread over about 68,000 square kilometers in dry areas. These infertile areas are known by the names Reh, Kallar, Usar, Rakar, Dhur, Karl and Chopan etc. About 1.25 million hectares in Uttar Pradesh and 1.21 million hectares in Punjab exist as fallow. In recent years, the expansion of such soils is increasing in canal irrigation areas. These soils are formed in dry climates where waterlogging occurs due to evaporation followed by excessive irrigation. When water evaporates from the soil, the salts dissolved in the sub-soil are carried to the surface by capillary action. These soils have high concentration of salts such as sodium, potassium and magnesium, hence are infertile. They do not support any plant growth. They are found in arid and semi-arid and marshy areas. Saline and alkaline soils can form in tidal waters adjacent to coastal areas. They also lack of nitrogen and calcium. Saline soils are more widespread in western Gujarat and the Rann of Kutch. Sea water inundates the land during the monsoon season, and after a few months the water evaporates, leaving a salty layer on top. Sea water also inundates the deltas of the Sunderbans in West Bengal, facilitating the presence of saline soils. In the regions such as Punjab and Haryana, excessive irrigation is followed by dry seasons, resulting in salt deposits to form fertile soils. These soils are cultivated by mixing gypsum and other organic fertilizers.

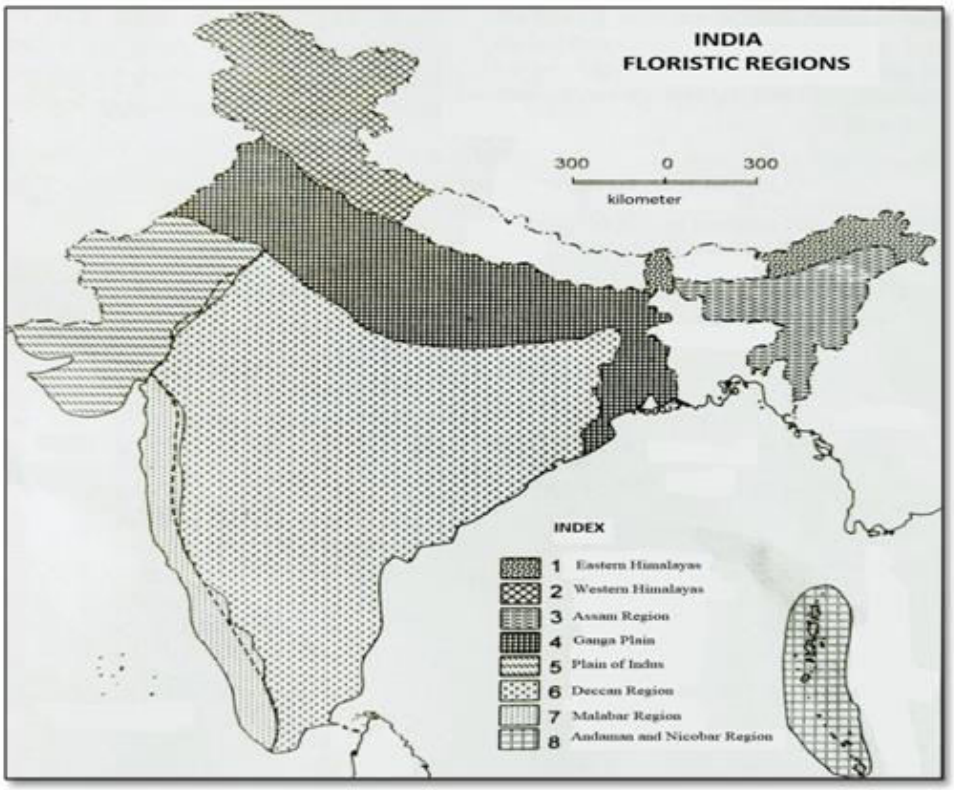
5.3.2 CHARACTERISTICS OF INDIAN SOILS

Indian soils are different in their composition from the soils of other countries, because they are very old and mature. Most of the soils of India are ancient alluvial soils which are not only formed by fragmentation of parent rocks, but climatic factors and water transport also have a hand in their formation. Almost all soils are deficient in nitrogen, organic matter, vegetable matter and mineral salts. The soil temperature is found to be high. They are 10°C to 15°C higher than temperate tropical soils. The soil cover is thin and scattered in the plateau and hilly regions, while it is deep and organized in the plains and deltaic regions. Due to continuous cultivation, along with the loss of fertility of Indian soils, their erosion is also taking place. Due to tropical climate and seasonal rainfall, these soils require irrigation to maintain the moisture level and use of chemical fertilizers. Some areas of the country are suffering from the problem of salinity and aridity due to which the fertile soils are getting degraded.

5.3.3 FLORISTIC REGIONS OF INDIA

The credit goes to Hooker and Thomson in 1855 for highlighting the regional characteristics of the natural vegetation of the country. Later C.B. Clarke (1898) divided this part of Asia into 6 floral regions: (1) the Himalayan region— (a) the eastern Himalayas, and (b) the western Himalayas, (2) the arid region, (3) the Malabar region, (4) the Coromandel region, (5) the Gangetic plain, and (6) the Assam region. In 1907 JD Hooker identified 8 floral regions in British India. These include (1) the Eastern Himalayas, (2) the Western Himalayas, (3) the Indus Plain, (4) the Gangetic Plain, (5) the Malabar Region, (6) the Deccan Region, (7) the Maldives and Sri Lanka, and (8) Burma (not in India). CC Calder in 1937 identified 6 floral regions in the country: (1) the North-Western Himalayas, (2) the Eastern Himalayas, (3) the Indus Plain, (4) the Gangetic Plain, (5) the Deccan Region, and (6) Malabar region. In 1939, D. Chatterjee divided India into 8 main floral regions based on some indigenous plant species in different parts of the country.

Fig. 5.2: Floristic Regions of India.



Source: Tiwari, R.C., Geography of India, 2016

1. Eastern Himalayas – This region includes the hilly regions of West Bengal, Sikkim and Arunachal Pradesh which is characterized by heavy rainfall, low snowfall, high temperature and humidity. This region with undulating topography supports about 4,000 species of plants which vary from tropical to temperate and alpine with increasing altitude. Sal, Oak, Chestnut are the main trees in the subtropical forests extending from the Terai plains to an altitude of 1524 meters. Between 1524 m and 3657 m temperate broad-leaf trees such as Quercus lamellosa Smith, Quercu linet blu, Quercus pachyphylla kurz, Castanopsis, Magnolia, Pyrus and Simplex meliosmia dominate. Between 743 m and 3657 m there is a belt of coniferous forest with trees like Abies webbiana, Picea simplecos, Urea etc. Beyond 3657 m there is an area of alpine forests with main trees like Silver, Cedar, Juniper, Pine.

2. Western Himalayas – This region covering Uttarakhand, Himachal Pradesh, Jammu and Kashmir, Ladakh receives lower rainfall and temperature than its eastern counterpart but snowfall is heavier. Here again subtropical (up to 1524 m), temperate (1524 m to 3657 m) and alpine (3657 m to 4572 m) vegetation types are observed with increasing altitude along the hill slopes. Up to the height of submontane region, semul and savanna types of vegetation are found. Pine, Oak, Cedar, Alder, Burch and Conifers are important in the temperate type vegetation. Similarly, between the height of 3657 to 4572 meters, the alpine vegetation is dominated by Juniper, Silver, Fur, Burch etc.

3. Assam Region - This region includes the entire Northeast including Assam, Meghalaya, Nagaland, Manipur, Tripura and Mizoram. The vegetation here reflects the South-East Asian influence, leaving the alpine vegetation and maintaining the diversity of the Himalayas. The region is rich in a variety of bamboo and palm trees and also has Nilgiri type grasslands at higher altitudes.

4. Ganga Plain - Being a unique geographical unit of the country, this region has its own unique floral characteristics. The type of vegetation ranges from semi-arid scrubland (Aravalli region) to evergreen mangroves (Gangetic Delta). Although the natural vegetation of the region has been destroyed due to population growth and increased agricultural and economy activities. Historical evidence supports a dense vegetation cover with rich wildlife in past. Sal and Aage

(Terminalia tomentosa and Terminalia belerica) are representative species of primitive vegetation. The vegetation of Uttar Pradesh is of deciduous type, which changes to moist deciduous type in eastern Bihar and West Bengal and to split forest type in the Ganga delta. In addition, there are different types of grasses throughout the region, which have a profound effect on the local physical conditions.

5. Plain of Indus - This floral region includes the plains of Haryana, Punjab, Rajasthan (west of Aravalli, Kutch and northern part of Gujarat). In this area with little rainfall (less than 75 cms annually), however, shrubs and trees with thick bark predominate. Important trees include are Acacia, Euphorbia. Cacti, Will Palm (Phoenix sylvestris), Khejda, Kanju and Pal etc. Small grasses also grow during the rains.

6. Deccan Region - This region covers most of the peninsula of India. Camamus vinylalis and Camamus rotary are the dominant palm species here. In areas formed by granite and gneiss, Teak, Sal trees are found, while in semi-arid areas there are thorny shrubs. Anderson (1863) and Mukherjee (1935) have tried to find out the similarity between these flora through their respective studies in Parasnath and Mahendragiri hills.

7. Malabar Region - This region extends along the west coast from the Gulf of Khambhat to the Kumari Cape. The type of vegetation here ranges from moist tropical evergreen to broad leaf mixed and monsoon deciduous types. The Nilgiri hills show temperate forests. The region also contains many species of plants native to Malaya.

8. Andaman and Nicobar Region - The flora of the region has been strongly influenced by Malayan and Burmese influences. It is mainly of tropical evergreen type with different types of palm trees, cane etc. Various types of shrubs and coconut trees are prominent in the vegetation of Lakshadweep islands.

5.3.4 NATIONAL FOREST POLICY

At present, the National Forest Policy has been adopted for the protection and development of forests. Forest policy was first adopted in India in 1894 AD. After independence, the forest policy was changed in 1894 and on 31 May 1952, the new forest policy was declared, according to which 33% of the land (20% in the plains and 60% in the hilly areas) should be

covered by forests. The 1952 policy was amended by the Government of India vide Resolution No. 3-1/1986-FP dated 7th December, 1988. The new National Forest Policy of 1988 replaced the 1952 Forest Policy with an emphasis on conservation and meeting of local needs. The main objective of the National Forest Policy, 1988 (NFP) is to ensure the stability and maintenance of ecological balance of the environment. The policy lays emphasis on the participation of people including women to achieve the objectives at large. In order to implement the forest policy announced in 1988, a 20-year long-term National Forestry Action Plan was implemented in August, 1999, which aims to stop deforestation and to cover the one-third area of the country with trees / forests.

The main objectives of the National Forest Policy, 1988 are as follows-

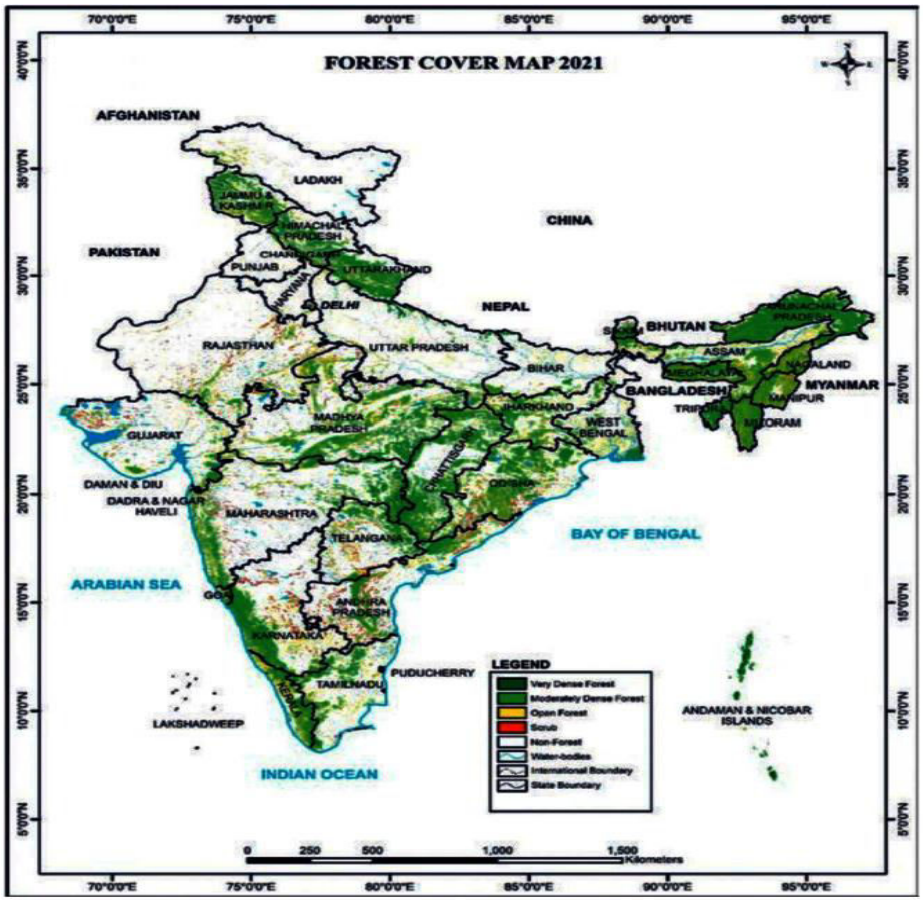
- Maintaining environmental balance by preserving and restoring ecological balance.
- Conservation of natural resources.
- Control over soil erosion and degradation of forests in the catchment area of rivers, lakes and reservoirs.
- Stopping the expansion of sand dunes in the desert areas of Rajasthan and coastal areas.
- Significant increase in forest-tree covers through extensive tree plantation and social forestry programmes.
- To take steps to meet the requirements of fuel wood, fodder and other minor forest produce for the rural and tribal population.
- Increase of forest products to meet the national needs.
- To promote the judicious use of forest products and to find optimum substitutes for timber and
- To achieve all the mentioned above objectives and to reduce the pressure on the existing forests, to obtain maximum cooperation from the general public, especially women, on a large scale.

According to the Forest Policy of 1952, from July 1952, the Government of India has started celebrating Van-Mahotsava. Tree Plantation Week is celebrated every year in the month of July-August.

5.3.5 DISTRIBUTION OF FORESTS

Data on forest cover in India are regularly available since 1901, when forests covered an area of about 240,000 square kilometers (22% of undivided India). The total Forest Cover of the country, as per the current assessment, is 7,13,789 sq kms which is 21.71% of the total geographical area of the country. Area covered by VDF is 99,779 sq kms (3.04%), MDF is 3,06,890 sq kms (9.33%) and OF is 3,07,120 sq kms (9.34%). In the current assessment, VDF and MDF together constitute 57% of the total Forest Cover of the country. The total forest and tree cover area of the country is 80.9 million hectares, which is 24.62 percent of the total geographical area of the country. Compared to the 2019 assessment, the country's total forest and tree cover has registered an increase of 2,261 sq kms. Out of this, an increase of 1,540 sq kms in forest cover and 721 sq kms in area covered by trees has been found. The highest increase in forest cover is observed in open forest, followed by very dense forest. The top three states showing an increase in forest area are Andhra Pradesh (647 sq kms), followed by Telangana (632

Fig. 5.3: Forest Cover Map of India (2021).



Source: India State of Forest Report (ISFR) - 2021

sq km) and Odisha (537 sq kms). In terms of area, Madhya Pradesh has the largest forest cover in the country. It is followed by Arunachal Pradesh, Chhattisgarh, Odisha and Maharashtra. In terms of forest cover as a percentage of total geographical area, the top five states are Mizoram (84.53%), Arunachal Pradesh (79.33%), Meghalaya (76.00%), Manipur (74.34%) and Nagaland (73.90%). Forests cover more than 33 percent of the geographical area of 17 States/Union Territories. Out of these States and Union Territories, five States/UTs viz. Lakshadweep, Mizoram, Andaman and Nicobar Islands, Arunachal Pradesh and Meghalaya have more than 75 percent forest cover while 12 States/UTs namely Manipur, Nagaland, Tripura, Goa, Kerala, Sikkim, Uttarakhand, Chhattisgarh, Dadra and Nagar Haveli and Daman and Diu, Assam, Odisha ranges from 33 percent to 75 percent forest. The total mangrove area in the country is 4,992 sq km. Compared to the previous assessment of 2019, an increase of 17 square kilometers has been found in the mangrove area. The top three states showing an increase in mangrove area are Odisha (8 sq kms), followed by Maharashtra (4 sq kms) and Karnataka (3 sq kms). The total carbon stock in the forest of the country is estimated to be 7,204 million tonnes and there is an increase of 79.4 million tonnes in the carbon stock of the country as compared to the last assessment of 2019. The annual addition to the carbon stock is 39.7 million tonnes.

Table-5.2: Forest Cover of India

S.No.	Class	Area (Sq kms)	% of Geographical Area
1.	Very Dense Forest (VDF)	99,779	3.04%
2.	Medium Dense Forest (MDF)	3,06,890	9.33%
3.	Open Forest (OF)	3,07,120	9.34%
4.	Total Forest Cover	7,13,789	21.71%
5.	Shrubs	46,539	1.42%
6.	Non-Forest Area	25,27,141	76.87%
7.	Total Tree Cover	95,748	2.91%
8.	Total Area Covered by Forests and Trees	8,09,537	24.62%

Source: India State of Forest Report (ISFR) - 2021

This report is prepared by Forest Survey of India (FSI) - Dehradun after every 2 years. FSI comes under the Ministry of Environment, Forest and Climate Change (MoEFCC). An amendment to the Forest (Conservation) Act, 1980 was proposed by the MoEFCC in October, 2021 to bring about significant changes in India's forest governance. Since 1987, the Indian Forest Status Report is published biennially by the Forest Survey of India. The 17th India's State of Forest Report was released on 13 January 2022. The data obtained from the Indian Remote Sensing Satellite Resource SAT-2 has been used for the assessment of forest and forest resources in this report. To bring accuracy in the report, scientific method has been adopted to check the data.

Table-5.3: Recorded Forest Areas (RFAs) in States and UTs (in sq kms)

SI.No.	States/ UTs	Geographical Area	RFA (in different categories)			Total RFA (2021)	% of GA
			RF	PF Forests *	Unclassed		
1.	Andhra Pradesh	1,62,968	31,959	5,069	230	37,258	22.86
2.	Arunachal Pradesh	83,743	12,371	11,857	27,312	51,540	61.55
3.	Assam	78,438	17,864	0	8,972	26,836	34.21
4.	Bihar	94,163	693	6,183	566	7,442	7.90
5.	Chhattisgarh	1,35,192	25,897	24,036	9,883	59,816	44.25
6.	Delhi	1,483	78	25	0	103	6.95
7.	Goa	3,702	119	755	397	1,271	34.33
8.	Gujarat	1,96,244	14,574	2,898	4,398	21,870	11.14
9.	Haryana	44,212	249	1,158	152	1,559	3.53
10.	Himachal Pradesh	55,673	1,883	28,887	7,178	37,948	68.16
11.	Jharkhand	79,716	4,500	18,922	1,696	25,118	31.51
12.	Karnataka	1,91,791	28,690	3,931	5,663	38,284	19.96
13.	Kerala	38,852	11,522	0	0	11,522	29.66
14.	Madhya Pradesh	3,08,252	61,886	31,098	1,705	94,689	30.72
15.	Maharashtra	3,07,713	50,865	6,433	4,654	61,652	20.13
16.	Manipur	22,327	984	3,254	13,180	17,418	78.01

17.	Meghalaya	22,429	1,113	12	8,371	9,496	42.34
18.	Mizoram	21,081	4,499	1,823	1,157	7,479	35.48
19.	Nagaland	16,579	234	0	8,389	8,623	52.01
20.	Odisha	1,55,707	36,049	25,133	22	61,204	39.31
21.	Punjab	50,362	44	1,137	1,903	3,084	6.12
22.	Rajasthan	3,42,239	12,176	18,543	2,144	32,863	9.60
23.	Sikkim	7,096	5,452	389	0	5,841	82.31
24.	Tamil Nadu	1,30,060	20,523	1,053	1,612	23,188	17.83
25.	Telangana	1,12,077	25,800	1,592	296	27,688	24.70
26.	Tripura	10,486	3,588	2	2,704	6,294	60.02
27.	Uttar Pradesh**	2,40,928	11,560	296	5,528	17,384	7.22
28.	Uttarakhand	53,483	26,547	9,885	1,568	38,000	71.05
29.	West Bengal	88,752	7,054	3,772	1,053	11,879	13.38
30.	A & N Islands	8,249	5,613	1,558	0	7,171	86.93
31.	Chandigarh	114	32	0	3	35	30.70
32.	Dadra & Nagar Haveli and Daman & Diu	602	203	5	6	214	35.55
33.	Jammu & Kashmir Shapefile Area*** (54,624)	2,22,236	17,648	2,551	0	20,199	36.98
34.	Ladakh Shapefile Area*** (1,68,055)		7	0	0	7	0.00
35.	Lakshadweep	30	0	0	0	0	0.00
36.	Puducherry	490	0	2	11	13	2.65
	Total	**32,87,469**	**4,42,276**	**2,12,259**	**1,20,753**	**7,75,288**	**23.58**

Source: State/UTs Forest Departments

**Unclassed Forest includes all forest other than Reserve Forest and Protected Forest as reported by State/UTs Forest Departments.*

***In case of Uttar Pradesh, the RFA excludes 9,962.764 km of linear plantations along road, Railway line and Canal.*

****Area of Shapefile provided by Survey of India (August, 2021). Notified geographical areas for individual UTs from Sol are awaited.*

5.3.6 GEOGRAPHICAL CLASSIFICATION OF FORESTS

There is asymmetry in altitude and climate in India. Plants follow the climate; there is asymmetry in their cover as a result. Special types of vegetations are found in the areas with a special type of altitude and temperature. Spatial heterogeneity in relief, slope direction, geological structure, soil, rainfall, temperature, humidity etc. complicates the demarcation of vegetation. Many scholars have attempted a geographical classification of the forests of India using various parameters. Sir Dudley Stamp has divided the vegetation of India into four parts on the basis of annual distribution of rainfall. After a detailed survey in 1936, HJ Champion divided India into four major vegetation zones on the basis of temperature and again on the basis of rainfall and humidity divided them into 15 faces and 136 sections. GS Puri revised it in 1960 and divided the vegetation of India into five main and 16 subclasses. For the convenience of the study, the vegetation of India has been divided into following five major and 14 minor sections-

MOIST TROPICAL FORESTS

(1) Tropical Wet Evergreen Forests- This type of vegetation is found where the average annual rainfall is more than 250 cm, the temperature is between 25°c to 27°c and the average annual humidity is more than 70%. These forests are mainly found in North Eastern India, western part of Western Ghats and Andaman-Nicobar Islands. This forest is very dense in which tall trees (about 45 meters) are found. It remains green throughout the year like the equatorial forests. In these forests, there is no grass on the ground, but due to the entangled reeds, palms, bamboos and vines, it is difficult to travel in them. From the point of view of economic importance, the wood of these forests is hard and durable. In the Sahyadri region, the main types of plants in these forests are Mesua, White Cedar, Kalophyllum, Tun, Dhoop, Hopia and Reed, while Gurjan, Chaplash, Mesua, Agor and Bamboo are found in the north-east region.

(2) Tropical Semi-Evergreen Forests- Evergreen forests degenerate and turn into semi-deciduous forests. These forests are found in areas where annual rainfall is between 200 cm to 250 cm, average annual temperature is between 24°c to 27°c and humidity is 80%. These forests

are found in the west coast, upper Assam, the slopes below the eastern Himalayas, the Odisha coast and the adjacent hills. Deciduous trees are also found in these forests along with evergreen trees, in which the height of trees ranges from 24 to 36 meters. Major trees include Anne, Bombax, Gutel, Hopia, Bentik, Kadam, Haldu, Laurel, Beeswax, Indian Chestnut, Champa, Mesua etc.

(3) Tropical Moist Deciduous Forests- These are monsoon forests. These forests are found in those parts of India, where average rainfall is 100-150 cm, average annual temperature is 24°C to 27°C and humidity is 60 to 80 percent. These forests are found in the Sahyadris, the north-eastern part of the peninsula and the foothills of the Himalayas. Trees like Teak, Sandalwood, Sal, Sakuya, Catechu, Rosewood, Harra, Mahua, Toon, Safflower, Rosewood, Lendi Tree etc are found in these forests which are very important economically. Here the average height of the trees is 30 to 40 meters and in March-April the trees of these forests shed their leaves.

(4) Tidal Forests- These are also called Mangrove forests. Such forests are found in the delta regions of Ganga, Brahmaputra, Kaveri, Krishna, Godavari and Mahanadi. These forests have special importance from commercial point of view. These forests are found in the tidal area of rivers along the coast. These forests remain submerged in the salty water of the sea. The roots of these forests are visible outside the water. The wood is hard and the bark is alkaline. Its main vegetation is Mangrove, Sundari, Casuarina, Phoenix, Kewra, Bendi. Sunderbans is located in the Ganga delta region of West Bengal, the Sundari tree here is used for house building and boat building. Mangrove forest protects the coasts from tsunami and cyclone. The total mangrove area in the country is 4992 square kilometers (0.15% of the country's geographical area). An increase of 17 sq km area has been registered in this. The top three states showing increase in mangrove area are Odisha (8 sq km), Maharashtra (4 sq km) and Karnataka (3 sq km).

DRY TROPICAL FORESTS

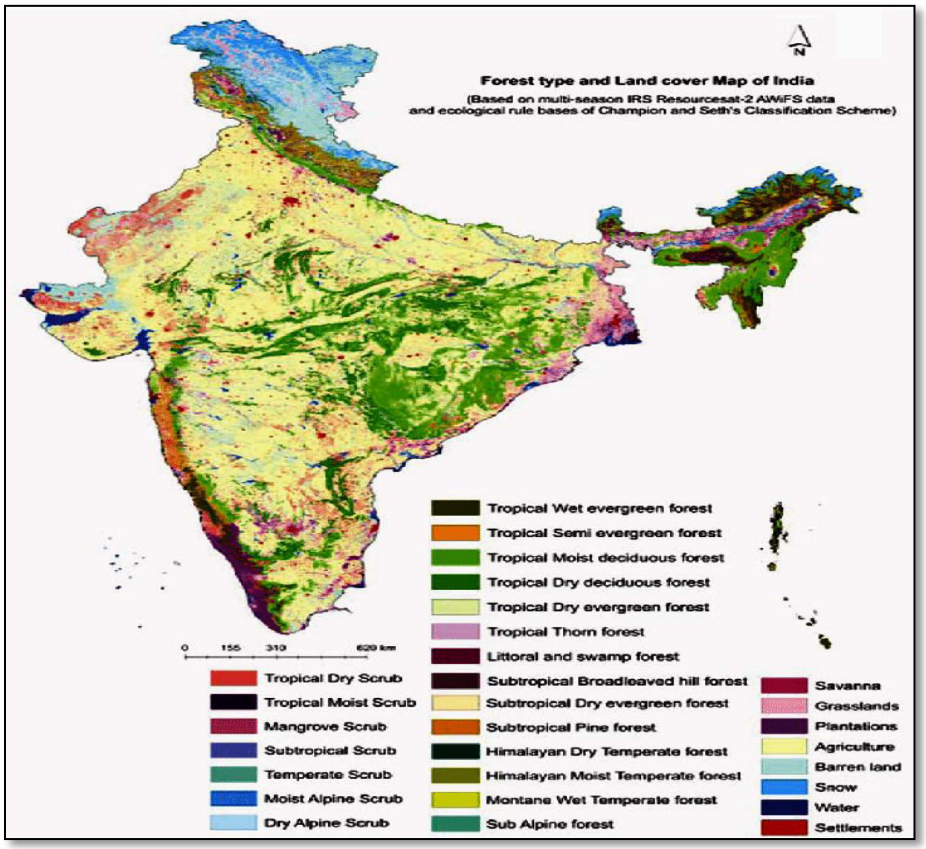
(5) Tropical Dry Deciduous Forests- Dry deciduous forest is found in areas with 70 to 100 cm annual rainfall, 15.5°C to 22.2°C average annual temperature and 63 to 77 percent relative humidity. These are degraded forms of moist deciduous forests. This type of forest extends over a large part of the country from the foothills of the Himalayas in the north to Kumari Cape in the south (except Rajasthan, Western Ghats and West Bengal), In which the territories of the states

of Uttar Pradesh, Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka etc. are included. Important trees of these forests include Teak, Tendu, Sal, Beeswax, Rosewood, Palash, Aegle Marmelos, Khair etc.

(6) Tropical Dry Evergreen Forests- The main trees of these forests include Khirni, Blackberry, Cocoa, Reetha, Tamarind, Neem, Palm, Cane etc. The height of these trees is 9 to 12 meters. These forests are found along the Coromandel Coast in India, where there is about 100 cm of rainfall from the returning monsoon, the average annual temperature is 28°C and the relative humidity is 74%.

(7) Tropical Thorn Forests- These forests are found in areas where the amount of rainfall is very low (50 cm to 75 cm), the average annual temperature is 25 °C to 27 °C and low humidity (less than 47%). The expansion of these forests is in South-West Punjab, Western Haryana, Western Uttar Pradesh, Central and Eastern Rajasthan, Western Madhya Pradesh, Kutch and

Fig. 5.4: Forest Type and Land Cover Map of India.



Source: Google Imagery

Saurashtra's adjacent region and Sahyadri's windward region. Major trees include Acacia, Euphorbia, Date, Hawthorn, Khair, Kanju, Cocoa, Jhau etc. The trees present in the thorny forest have long roots, which penetrate deep into the soil in search of water. The leaves are also thick and small in these trees to reduce evaporation. Due to the lack of rainfall, the height of the trees varies from 6 to 9 meters and between these there are areas of thick grasses.

MONTANE SUB-TROPICAL FORESTS

(8) Sub-Tropical Moist (Pine) Forests- These forests are found in those regions, where 100-200 cm. Annual rainfall ranges from 15 to 22 °C, and humidity ranges from 36 to 77 percent. These forests are found on the slopes of north-west Himalayas (except Ladakh and Jammu and Kashmir), Khasi hills, Arunachal Pradesh and north-eastern hill states. Pine is the main vegetation of this forest. Apart from this, Oak, Blackberry and Rhododendron bushes and thick grasses are also found in the rainy season.

(9) Sub-Tropical Dry Evergreen Forest- These forests are found in Punjab, Haryana and Kashmir in the foothills of the Himalayas between the height of 450 meters to 1500 meters. Here the average annual temperature is 20°C (10°C in January and 32°C in June), rainfall is between 50 cm to 100 cm and the number of rainy days is found between 26 to 38. Most of the rainfall occurs between October and December during the brief northeast monsoon. During the long dry season, high temperatures can reach 44°C or more. The amount of annual rainfall generally decreases from east to west in front of the Shivalik range. There are only forests with a shrubby, closed-canopy forest structure that rarely exceeds 10 meters in height. The old woodlands are draped in lianas. Manilkara hexandra, Diospyros ebernum (Ceylon ebony), Strychnos nuxvomica (strychnine tree), Drypetes sepiaria and Flacourtia indica are some of the most prevalent trees.

(10) Sub-Tropical Wet Hill Forest- These areas receive more than 150 cm of rainfall, average annual temperature of 18°C to 24°C and humidity of 51 to 81%. These forests are mainly spread in Nilgiris, Palani hills (height 900 m to 1050 m), Mahabaleshwar, Pachmarhi (900 m), lower slopes of Eastern Himalayas (90 m to 180 m) and Assam hills. In which species of trees like Blackberry, Machilus, Elaeo carpus and Celitis are found. Oak and Chestnut are the main trees in the Eastern Himalayas. The average height of trees ranges from 15 meters to 30 meters, in which shrubs are found less.

MONTANE TEMPERATE FORESTS

(11) Wet Temperate Forests- More than 150 cm of annual rainfall, 18 degree centigrade average annual temperature (during December-February the temperature reaches freezing point and dense fog) is found. These forests are found in Nilgiris, Anaimalai, Palani hills (above 1500 m), Eastern Himalayas and Assam hills (1860 m to 2850 m). In South India, they are called Sholaj. Magnolia, Laurel, Rhododendrons, Plane, Elm, Plum are the main plant species of these forests. Oak, Chestnut and Laurel are the main trees in these forests in northern India.

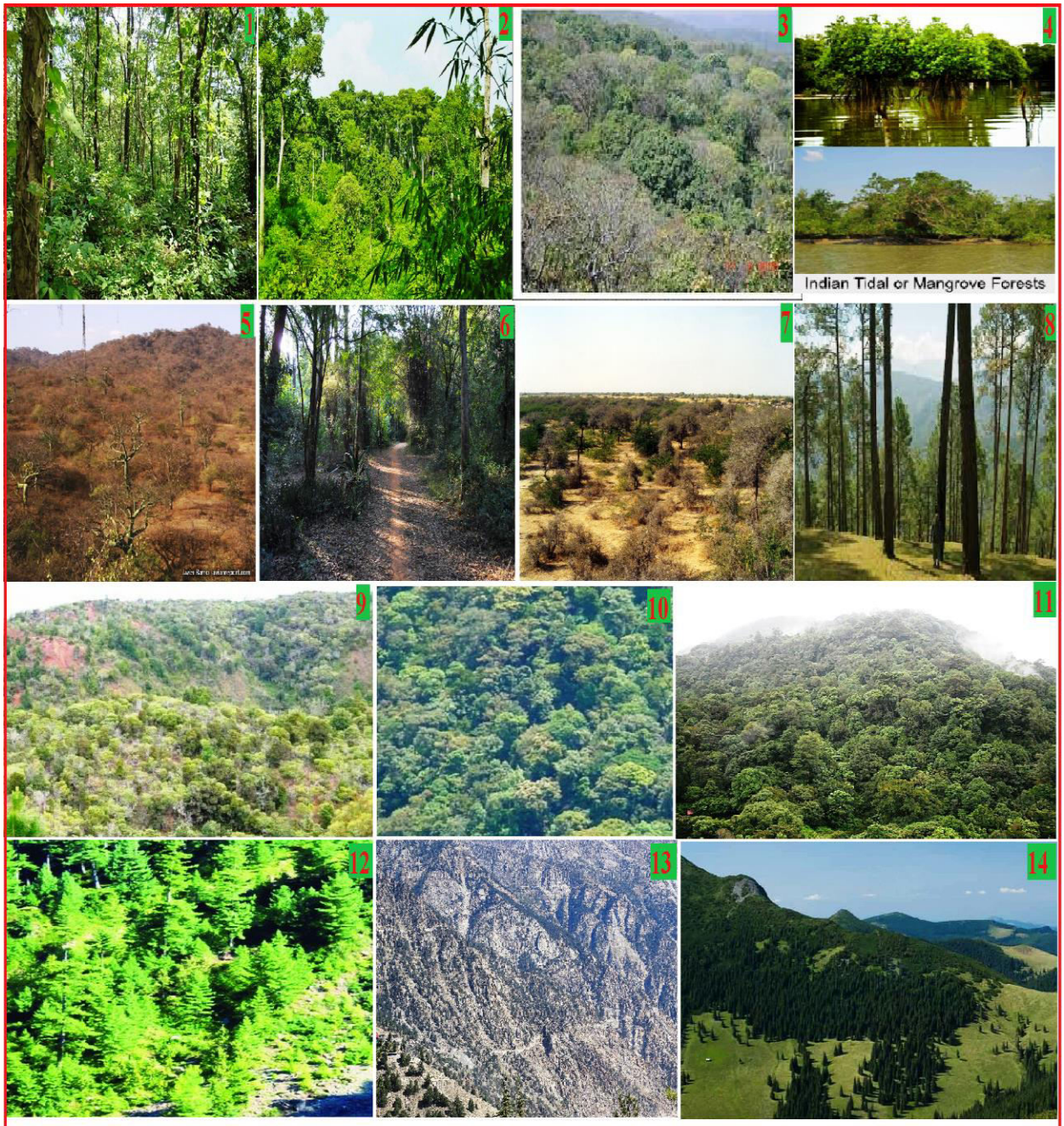
(12) Himalayan Moist Temperate Forests- Himalayan Moist Temperate Forest occurring in the temperate zone of the Himalayas between 1500 and 3300 metres, where the annual rainfall varies from 100 cm to 300 cm, the Himalayan moist temperate forests cover the entire length of this mountain range in Kashmir, Himachal Pradesh, Uttarakhand, Darjeeling, Sikkim and Arunachal Pradesh. The average annual temperature here is 12°C-13°C and the annual humidity is found to be 56 to 65%. In these broad-leaved evergreen and coniferous forests are mixed, in which the height of trees ranges from 30 to 45 meters. Oak, Pines, Cedars, Silver firs, Spruce etc. are the most important trees.

(13) Himalayan Dry Temperate Forests- Himalayan dry temperate forests can be found in the interior dry ranges of the Himalayas, where the southwest monsoon is minimal (Average annual rainfall less than 100 cm). They are also distributed in Ladakh, Lahul, Chamba, Kinnaur, Garhwal and Sikkim. This type of dry temperate forest is also found in the Trans-Himalayan region. These forests are found in areas with a height of more than 1500 meters. In these, trees like Cedar, Juniper, Maple and Oak are found along with xerophytes shrubs.

4.11.5 Alpine Forests

(14) **Alpine Forests**- These forests are found in the parts of the height of the Himalayas from 2800 meters to 4000 meters. The vegetation of the western Himalayas in these forests mainly consists of juniper, rhododendron, willow and black currant. The dominant flora of the Eastern Himalayas are Red Deodar, Black Juniper, Birch and Larch. Between the height of 2250 m to

Fig. 5.5: Types of Forests.



1. Tropical Wet Evergreen, 2. Tropical Semi-Evergreen, 3. Tropical Moist Deciduous, 4. Tidal/Mangrove, 5. Tropical Dry Deciduous, 6. Tropical Dry Evergreen, 7. Tropical Throne, 8. Sub-Tropical Moist (Pine), 9. Sub-Tropical Dry Evergreen, 10. Sub-Tropical Wet Hill, 11. Wet Temperate, 12. Himalayan Moist Temperate, 13. Himalayan Dry Temperate & 14. Alpine Forests.

Source: Google Images

2750 m on the Pirpanjal mountain ranges, intermediate alpine meadows are found between the upper snow zone and the lower thin cone forest zone.

5.3.7 WILDLIFE IN INDIA

About 75,000 species of animals are found in India. Among them there are 350 mammals, 1,313 birds, 408 reptiles, 197 amphibians, 2,546 fish, 50,000 insects, 4,000 molluscs and other invertebrates. This is 13% of the world total. Many rules and regulations have been passed from time to time for the protection and conservation of wildlife. The 'Wild Birds and Animals Protection Act' was passed in 1887, but it was changed in 1912. The main objective of the 'Forest Act' passed in the year 1927 is to protect wild animals. The 'Indian Board of Wildlife' was established in 1952 for the protection of wild animals. 'Wildlife Board' was also formed at the provincial level. In India, the Wildlife Protection Act has been effective since 1972, under which trade in rare and endangered species has been banned. National parks and wildlife sanctuaries were established in the Wild Life Act. Wild life sanctuaries are formed for the protection of any one species or some specific species, that is, they are 'specific species based protected areas'. On the contrary, National Parks are formed for the protection of a special type of refuge, that is, they are 'habitat oriented'. There are 567 existing wildlife sanctuaries in India covering an area of 122,564.86 km^2, which is 3.73% of the geographical area of the country (National Wildlife Database, Jan. 2023). Another 218 sanctuaries are proposed in the Protected Area Network Report covering an area of 16,829 km^2. Forests and wildlife have been kept in the concurrent list of the constitution.

National Parks of India

There are 106 existing national parks in India covering an area of 44,402.95 km^2, which is 1.35% of the geographical area of the country (National Wildlife Database, Jan. 2023). India's first national park is Jim Corbett Nainital (Uttarakhand), its old name was Hailey National Park, which was established in 1935. Madhya Pradesh has the maximum number of national parks in the country. India's largest national park is in Leh district, its name is Himis. Nagarjuna Sagar (Andhra Pradesh) is the largest tiger reserve in India. Dachigam Sanctuary is the only sanctuary where the Kashmiri antelope is found. The Zoological Survey of India was established in 1916 AD and its **headquarter** is in Kolkata. The Botanical Survey of India was established in 1970. The Andaman-Nicobar Islands have the largest number of wildlife sanctuaries. Bandhavgarh

National Park located in Madhya Pradesh is famous for Bengal Tiger. Nanda Devi National Park, located on the summit of Nanda Devi in Uttarakhand, became a national park in 1982. There is a valley of flowers under this area, where different types of flowers are scattered. Dudhwa National Park (Uttar Pradesh) forms the international border with Nepal. It was given the status of a national park in 1977. The Manas Sanctuary (Assam) National Park, included in the UNESCO World Heritage List, is also the famous Tiger and Alien Reserve of the country. It is named after the Manas river flowing from the west side of the Manas Garden. Apart from the one-horned rhinoceros, many other rare animals are also found here. Periyar Sanctuary is famous for wild elephants. The one horned rhinoceros is found in Assam and West Bengal. Indian rhinos are most commonly found in Kaziranga Sanctuary. Project Lion was started in 1972 AD. Project Tiger was started in 1973 AD. Gharial project was started in 1974 AD. Project Rhinoceros was started in 1987 AD. Snow-leopard project was started in 1987 AD. Crocodile breeding project was started in 1975 AD. The world famous Keoladeo (Bharatpur) National Park is home to two and a half million birds. Elephant is the most important among the mammals. They are found in the hot and humid forests of Assam, Karnataka and Kerala. The one-horned rhinoceros lives in the swampy areas of West Bengal and Assam. India is the only country in the world where both lion and tiger are found. The natural habitat of Indian lions is the Gir forest in Gujarat. Tigers are found in the forests of Madhya Pradesh and Jharkhand, Sundarbans of West Bengal and Himalayan regions. In the snowy heights of Ladakh, there are yaks, which are bull-like creatures with tufted horns, which weigh about a ton. Tibetan Reindeer, bharal (Blue Sheep), Wild Sheep, and Kiang (Tibetan wild Ass) are also found in India.

Table 5.4: List of National Park.

State	Number of Parks	Name of National Park	Established Year	Area (km^2)
Andaman & Nicobar Islands	9	Saddle Peak National Park	1979	32.54
		North Button Island National Park	1979	0.44
		Middle Button Island National Park	1987	0.44
		Mahatma Gandi Marine National Park	1983	281.5
		Galathea Bay National Park	1992	110
		Campbell Bay National Park	1992	426.23

		Mount Harriett National Park	1987	46.62
		Rani Jhansi Marine National Park	1996	256.14
		South Button Island National Park	1987	0.03
Arunachal Pradesh	2	Mouling National Park	1986	483
		Namdapha National Park	1983	1808
Assam	7	Nameri National Park	1998	200
		Manas National Park	1990	500
		Kaziranga National Park	1974	859
		Dibru-Saikhowa National Park	1999	340
		Dihing Patkai National Park	2021	234
		Raimona National Park	2021	422
		Rajiv Gandhi Orang National Park	1999	78.81
Bihar	1	Valmiki National Park	1989	335.65
Andhra Pradesh	3	Rajiv Gandhi (Rameswaram) National Park	2005	2.4
		Papikonda National Park	2008	1013
		Sri Venkateswara National Park	1989	353.6
Goa	2	Vansda National Park	1979	23.99
		Mollem National Park	1992	107
Chhattisgarh	3	Indravati (Kutru) National Park	1982	1258.4
		Guru Ghasidas (Sanjay) National Park	1981	1440.7
		Kanger Valley National Park	1982	200
Haryana	2	Sultanpur National Park	1989	1.43
		Kalesar National Park	2003	46.82
Jammu & Kashmir	4	Dachigam National Park	1981	141
		Hemis National Park	1981	3350
		Kishtwar National Park	1981	425
		Salim Ali National Park	1992	9
Karnataka	5	Bannerghatta National Park	1974	260.51
		Bandipur National Park	1974	874.2
		Anshi National Park	1987	417.34
		Nagarahole (Rajiv Gandhi) National Park	1988	643.39
		Kudremukh National Park	1987	600.32
Jharkhand	1	Betla National Park	1986	226.33
Madhya Pradesh	10	Kanha National Park	1955	940
		Indira Priyadarshini Pench	1975	292.85

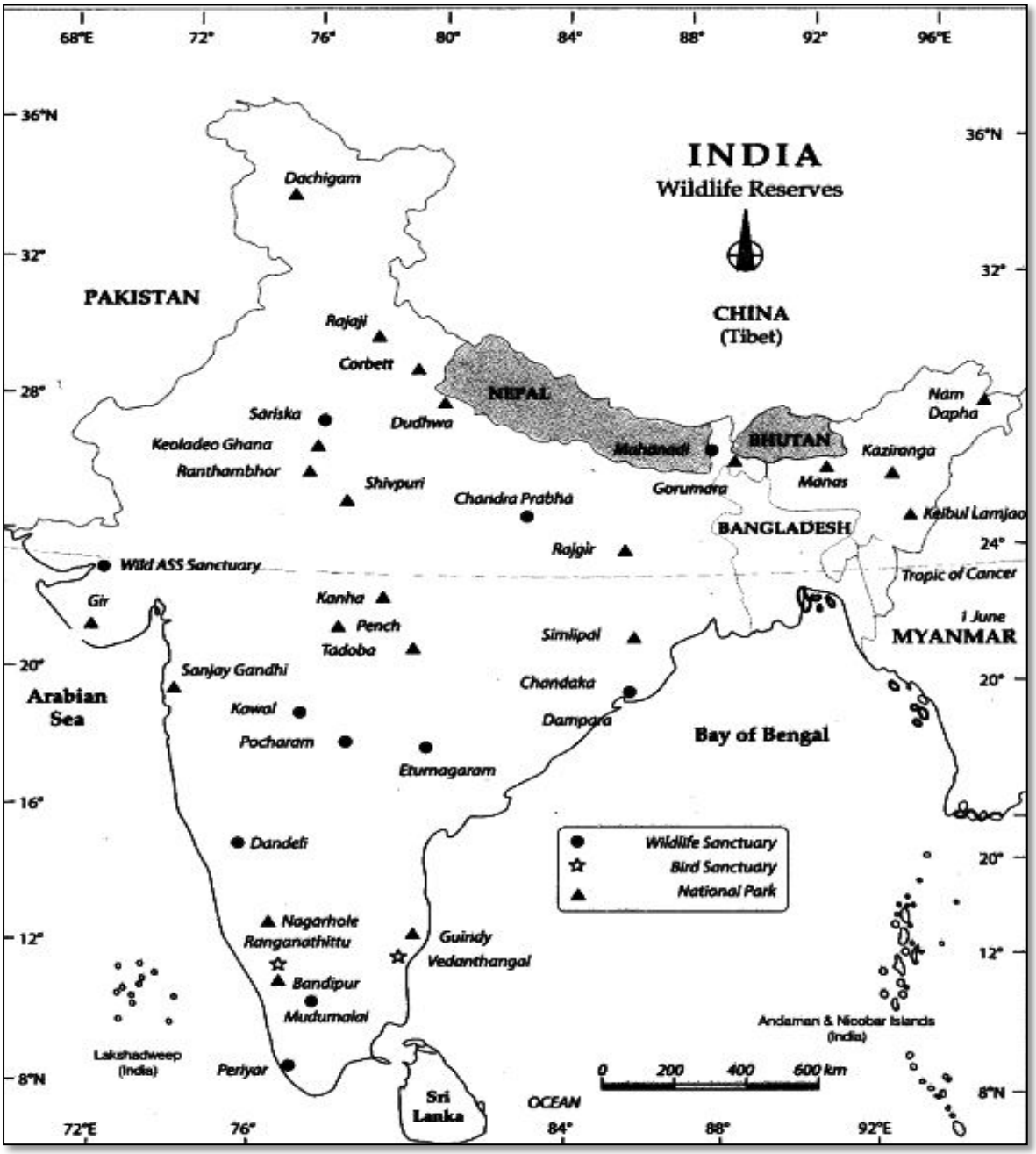
		National Park		
		Fossil National Park	1983	0.27
		Dinosaur Fossils National Park	2011	0.8974
		Bandhavgarh National Park	1968	448.85
		Panna National Park	1981	542.67
		Madhav National Park	1959	375.22
		Satpura National Park	1981	585.17
		Sanjay National Park	1981	466.88
		Van Vihar National Park	1979	4.45
Kerala	6	Mathikettan Shola National Park	2003	12.82
		Eravikulam National Park	1978	97
		Anamudi Shola National Park	2003	7.5
		Pambadum Shola National Park	2003	1.318
		Silent Valley National Park	1984	89.52
		Periyar National Park	1982	350
Manipur	1	Keibul-Lamjao National Park	1977	40
Maharashtra	6	Nawegaon National Park	1975	133.88
		Gugamal National Park	1975	361.28
		Chandoli National Park	2004	317.67
		Sanjay Gandhi (Borivilli) National Park	1983	86.96
		Tadoba National Park	1955	116.55
		Pench (Jawaharlal Nehru) National Park	1975	257.26
Mizoram	2	Phawngpui Blue Mountain National Park	1992	100
		Murlen National Park	1991	50
Nagaland	1	Intanki National Park	1993	202.02
Meghalaya	2	Nokrek Ridge National Park	1986	47.48
		Balphakram National Park	1985	220
Odisha	2	Simlipal National Park	1980	845.7
		Bhitarkanika National Park	1988	145
Sikkim	1	Khangchendzonga National Park	1977	1784
Rajasthan	5	Mukundra Hills National Park	2006	200.54
		Keoladeo Ghana National Park	1981	28.73
		Desert National Park	1992	3162
		Ranthambhore National Park	1980	282
		Sariska National Park	1992	273.8
Telangana	3	Mahaveer Harina Vanasthali	1994	14.59

		National Park		
		Kasu Brahmananda Reddy National Park	1994	1.43
		Mrugavani National Park	1994	3.6
Tamil Nadu	5	Indira Gandhi (Annamalai) National Park	1989	117.1
		Gulf of Mannar Marine National Park	1980	6.23
		Guindy National Park	1976	2.82
		Mukurthi National Park	2001	78.46
		Mudumalai National Park	1990	103.23
Uttar Pradesh	1	Dudhwa National Park	1977	490
Tripura	2	Bison (Rajbari) National Park	2007	31.63
		Clouded Leopard National Park	2007	5.08
Uttarakhand	6	Nanda Devi National Park	1982	624.6
		Govind National Park	1990	472.08
		Gangotri National Park	1989	2390.02
		Corbett National Park	1936	520.82
		Rajaji National Park	1983	820
		Valley of Flowers National Park	1982	87.5
West Bengal	6	Jaldapara National Park	2012	216.51
		Gorumara National Park	1992	79.45
		Buxa National Park	1992	117.1
		Singalila National Park	1986	78.6
		Neora Valley National Park	1986	159.89
		Sunderban National Park	1984	1330.1

Source: https://www.google.com/

Presently there are 18 Biosphere Reserves in India. Biosphere Reserve is an area protected by the National Government for the protection of plants and animals as, they conserve the biodiversity of that area. UNESCO has introduced the designation 'Biosphere Reserve' for natural areas to reduce the conflict between development and conservation. Biosphere reserves are designated by a National Government that meets minimum criteria under UNESCO's Man and Biosphere Reserves programme.

Fig. 5.6: Some Wildlife Reserves of India.



Source: Google Imagery

Table 5.5: Biosphere Reserves in India.

S. No.	Name	Date of Notification	Area (in km^2)	Location (State)
1	Nilgiri	01.09.1986	5520	Part of Wayanad, Nagarhole, Bandipur and Madumalai, Nilambur, Silent Valley and Siruvani hills (Tamil Nadu, Kerala and Karnataka).
2	Nanda Devi	18.01.1988	5860.69	Part of Chamoli, Pithoragarh, and Bageshwar districts (Uttarakhand).
3	Nokrek	01.09.1988	820	Part of Garo hills (Meghalaya).
4	Great Nicobar	06.01.1989	885	Southern most islands of Andaman and Nicobar (A&N Islands).
5	Gulf of Mannar	18.02.1989	10,500 km^2 Total Gulf area (area of Islands 5.55 km^2)	Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu).
6	Manas	14.03.1989	2837	Part of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang districts (Assam)
7	Sunderbans	29.03.1989	9630	Part of delta of Ganges and Brahamaputra river system (West Bengal).
8	Simlipal	21.06.1994	4374	Part of Mayurbhanj district (Orissa).
9	Dibru-Saikhowa	28.07.1997	765	Part of Dibrugarh and Tinsukia Districts (Assam)
10	Dehang-Dibang	02.09.1998	5111.50	Part of Siang and Dibang Valley in Arunachal Pradesh.
11	Pachmarhi	03.03.1999	4926	Parts of Betul, Hoshangabad and Chindwara districts of Madhya

				Pradesh.
12	Khangchendzonga	07.02.2000	2619.92	Parts of Khangchendzonga hills and Sikkim.
13	Agasthyamalai	12.11.2001	1828	Neyyar, Peppara and Shendurney Wildlife Sanctuaries and their adjoining areas in Kerala.
14	Achanakamar - Amarkantak	30.3.2005	3835.51	Covers parts of Anupur and Dindori districts of M.P. and parts of Bilaspur districts of Chhattishgarh State.
15	Kachchh	29.01.2008	12,454	Part of Kachchh, Rajkot, Surendra Nagar and Patan Civil Districts of Gujarat State
16	Cold Desert	28.08.2009	7770	Pin Valley National Park and surroundings; Chandratal and Sarchu&Kibber Wildlife Sancturary in Himachal Pradesh
17	Seshachalam Hills	20.09.2010	4755.997	Seshachalam Hill Ranges covering parts of Chittoor and Kadapa districts of Andhra Pradesh
18	Panna	25.08.2011	2998.98	Part of Panna and Chhattarpur districts in Madhya Pradesh

Source: https:www.google.com/

5.4 SUMMARY

Soil and natural vegetation has a close relationship. Soil is vital to plant life, and plants cannot fully grow without the soil. Soil is an important source of plant nutrition, climate, and related human interactions with local environments. It adapts the vegetation to the existing soil and supports the high quality growth of the vegetation in the local environment. Soil provides nutrients for plants, such as nitrogen, potassium, phosphorus, soil furate, etc. Without these nutrients, plants cannot grow healthily and their growth, flowers, fruits, seeds, etc. can be affected. Plants are also important to the soil because they help to protect the soil. Vegetation

prevents soil compaction, stores water by holding water in the soil, and helps to protect the soil from the atmospheric effects of the atmosphere. The roots of the plants strengthen the soil and provide nutrition to the plants. In short, soil and natural vegetation are integrated with each other and are essential for the growth of vegetation and the balance of the earth. The energy provided by the soil nutrients and the protection of the soil through vegetation, both of these influence each other and help in establishing a balanced environment.

Soil and vegetation conservations are two interrelated aspects of environmental preservation that focus on protecting and preserving the soil and plant life. Soil conservation involves taking measures to protect and sustain the soil, which is a vital natural resource that provides essential components such as nutrients, water, and energy for life on Earth. Soil faces threats such as erosion, climate change, and deforestation. Soil conservation efforts may include practices like preventing soil erosion, using soil conservation tools, developing environmental management systems, and implementing water conservation measures. Vegetation conservation refers to the protection and preservation of forests and plant life. Vegetation plays a crucial role in supporting life on our planet and serves as a habitat for high biodiversity. Vegetation provides various benefits, such as oxygen production, air purification, water source protection, soil stabilization, and safeguarding of biological resources. Measures for vegetation conservation may include preventing illegal logging, promoting a forestation and reforestation, and adapting to the impacts of climate change. Both soil and vegetation conservations are essential because they contribute to the preservation of natural resources, ensure the quality of life, and provide a sustainable environment for the future generations. By protecting and conserving soil and vegetation, we can maintain ecological balance, mitigate the effects of climate change, and promote overall environmental well-being.

4.5 GLOSSARY

Soil - The loose and unorganized earth materials produced by the disintegration and weathering of rocks are called soil. Soils are natural objects made up of animals, minerals and organic matter, in which there are different layers of different thickness.

Tarai - lowland region in northern India and southern Nepal, located south of the Sivalik Hills and north of the Indo-Gangetic Plain.

Alluvial - River drained soils, or transported soil

Bhangar - Old Alluvium

Khadar - New Alluvium

Bhabar - Pebbly soils

Black soil - Cotton soil, regur soil

Laterite - Brick, later of Latin language

Desert soils - Result of mechanical weathering

Reh - Layer of salts-sodium, calcium and magnesium

Mountain soils - coarse and pebbly soils

Virgin vegetation - a plant community which has grown naturally without human aid and has been left undisturbed by humans for a long time.

Evergreen - do not leave in any part of the year

Deciduous - Shed the leaves in spring season

Biodiversity - The diversity of species of plants and animals in an ecosystem with specific environmental conditions is called biodiversity.

Forest Cover – All the land whose area is more than 1 hectare and tree density is more than 10%.

Very Dense Forest (VDF) - All lands with tree canopy density of 70 percent and above.

Moderately Dense Forest (MDF) - All lands with tree canopy density of 40 percent and more but less than 70 percent.

Open Forest - All lands with tree canopy density of 10 percent and more but less than 40 percent.

Scrub – Forest land with canopy density less than 10 percent.

Non-Forest – Lands not included in any of the above classes (includes water).

5.6 ANSWER OF CHECK YOUR PROGRESS

1. India has a large variety of soils.
2. The Indian Council of Agricultural Research classified Indian soil into 8 major and 27 minor divisions.
3. These eight major soil groups include - Alluvial, Red, Black, Laterite, Desert, Mountain, Forest and Peat soil.
4. Alluvial soils are the most dominant soils of India.
5. The Alluvial soils covers an area of 14.25 lakh square kilometers (43.4%)
6. Alluvial soils are fertile soils and are known for the production of food and commercial crops.
7. Bhangar is the old alluvium and darker in colour.
8. Khadar is the new alluvium and light in colour.
9. Black soils are the dust of Deccan lava.
10. Black soils are famous for the production of cotton.
11. Black soils are well-known for their capacity to hold moisture.
12. Red and yellow soils have variations in colour due to iron content.
13. Laterite has been derived from the Latin word ‘later’ which means brick.
14. Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for crops like cashew nut.
15. Laterite soils are typical soils, known for pastures and scrub forests.
16. Alkaline soils are salty soils.
17. Reh is a mixture of salts like sodium Carbonate, Sulphate calcium and Magnesium.
18. Mountain soils are the product of mechanical weathering in the hilly region.
19. Peaty soils are the soils of humid region.
20. Forest soils are organic soils.
21. Forest soils are loamy and silty in valley sides and coarse grained in the upper slopes.
22. Marshy soils are found on the dry surface of rivers and lakes.
23. The removal or transfer of soil cover is called soil erosion.
24. Soil conservation includes all those measures by which soil erosion is controlled and soil fertility is brought back.

25. Natural vegetation is called such trees and plants, which grow and grow on their own without the effort of man.
26. In 1939, D. Chatterjee divided India into 8 main floral regions based on some indigenous plant species in different parts of the country.
27. The new National Forest Policy of 1988 replaced the 1952 Forest Policy with an emphasis on conservation and meeting local needs.
28. From July 1952, the Government of India has started celebrating Van-Mahotsava.
29. Tree Plantation Week is celebrated every year in the month of July-August.
30. The total forest and tree cover area of the country is 80.9 million hectares, which is 24.62 percent of the total geographical area of the country in 2021.
31. Compared to the 2019 assessment, the country's total forest and tree cover has registered an increase of 2,261 sq kms in 2021.
32. The total Forest Cover of the country, as per the current assessment is 7,13,789 sq km which is 21.71% of the total geographical area of the country in 2021.
33. Sir Dudley Stamp has divided the vegetation of India into four parts on the basis of annual distribution of rainfall.
34. Forests mean a large group of trees and also include grasses and scrub.
35. Climate and physiography are the most determining factor to determine the types of forests.
36. Rainfall is a great bearing on the type of vegetation.
37. The amount of rainfall has determined tropical evergreen, tropical deciduous, tropical dry and desert forests.
38. Relief has given two main types-Mountains and Alpine forests.
39. Location has produced tidal, coastal and riverine forests.
40. Among soils, sandy, khadar, Bhangar have affected the types of vegetation.
41. Himalayas have variation in vegetation with the change in altitude.
42. Tropical Deciduous Forests are known as monsoon forests.
43. Tropical deciduous forests are economically more important.
44. Tropical evergreen forests are the forests of high amount of rainfall area.
45. Desert forests are the product of scanty rainfall.
46. Alpine forests are high altitude forests.

47. Tidal forests are also known as deltaic forests
48. Sunderban are tidal forests of Ganga delta, these are home of Bengal Tiger.
49. Coastal forests are littoral forests.
50. About 75,000 species of animals are found in India and among them there are 350 mammals, 1,313 birds, 408 reptiles, 197 amphibians, 2,546 fish, 50,000 insects, 4,000 molluscs and other invertebrates.

5.7 REFERENCES

1. Dwevedi, A., Kumar, P., Kumar, P., Kumar, Y., Sharma, Y.K., & Kayastha, A.M. (2017), Soil sensors: detailed insight into research updates, significance, and future prospects, New Pesticides and Soil Sensors, Elsevier Publication, Netherlands.

2. India State of Forest Report (ISFR) – 2021, Forest Survey of India (FSI), an organization under the Ministry of Environment Forest & Climate Change, Government of India.

3. Khullar, A. & Rao, J.A.C.S. (2019), Enviournment, McGraw Hill Education (India) Pvt. Limited, Chennai.

4. Mamoriya, C. (2000), Advance Geography of Modern India, Sahitya Bhawan Publishers and Distributers Li., Agra.

5. Shreewastav, V.K. (2015), Regional Planning & Balanced Development, Vasundhara Prakashan, Gorakhpur.

6. Singh, Savindra (2016), Biogeography, Pravalika Publications, Prayagraj.

7. Singh, Savindra (2020), Physical Geography, Pravalika Publication, Prayagraj.

8. Tiwari, R.C. (2016), Geography of India, Prawalika Publications, Prayagraj.

9. https://www.researchgate.net/figure/Different-soils-found-in-India-A-black-soil-B-alluvial-soil-C-red-soil-D_fig2_313351187

10. https://fsi.nic.in/

11. https://www.google.com/

5.8 TERMINAL QUESTIONS

(A) Long Answer

1. Discuss the classification and types of Indian soils?
2. Explain soil erosion and its disadvantages?

3. Describe the floristic regions of India with a map?

4. Explain the geographical classification of forests of India?

(B) Short Answer

1. Define soil.

2. Define Natural Vegetation.

3. Difference between Bangar and Khadar?

4. Describe the characteristics of Indian soils.

5. What is Soil Conservation? Explain its measures.

6. State the importance of forests?

7. Explain the National Forest Policy.

8. Describe the distribution of forests in India.

9. Write an essay on mountain forests of India.

(C) Objective Questions

1. Which state is not known for tropical evergreen forests-?

(a) Rajasthan

(b) West Bengal

(c) Meghalaya

(d) Nagaland

2. Which of the following soil type is most suitable for the cultivation of cereals?

(a) Alluvial soils

(b) Red soils

(c) Laterite soils

(d) None of these

3. What is the other name of Regur soil?

(a) Black soil

(b) Red soil

(c) Alluvial soil

(d) Laterite soil

4. The forest in Sundarbans is also called?

(a) Scrub jungle

(b) Mangrove

(c) Deciduous forest

(d) None of these

5. Bandipur National park is located in which of the given states?

(a) Andhra Pradesh

(b) Rajasthan

(c) Assam

(d) Karnataka

6. Which one of the given below, Van Mahotsav is associated?

(a) Cutting of trees

(b) Harvesting festival

(c) Increase in crop production

(d) Tree Plantation

Answer– 1 (a), 2 a), 3 (a), 4 (b), 5(d), 6(d).

BLOCK-2 POPULATION AND OTHER HUMAN ASPECTS

UNIT- 6 POPULATION DISTRIBUTIONS, DENSITY AND GROWTH, POPULATION COMPOSITION, AGE, SEX, LITERACY AND OCCUPATIONAL STRUCTURE

6.1 OBJECTIVES

After having the detailed study of this unit you will be able to:

- Studies the distribution and density of population of India
- Know the growth of Population in India
- Know the Rural and Urban Population distribution in India
- Examine the composition of Population in India based on age, sex literacy and occupation
- Understand the factors influencing the population distribution and growth

6.2 INTRODUCTION

Population is the basic element of a state or a nation— it provides skilled manpower that can be geared towards the economic development of the country. The strength and progress of any nation resides in the quality of its population— educated, healthy and hardworking people contribute to the betterment and advancement of the country.

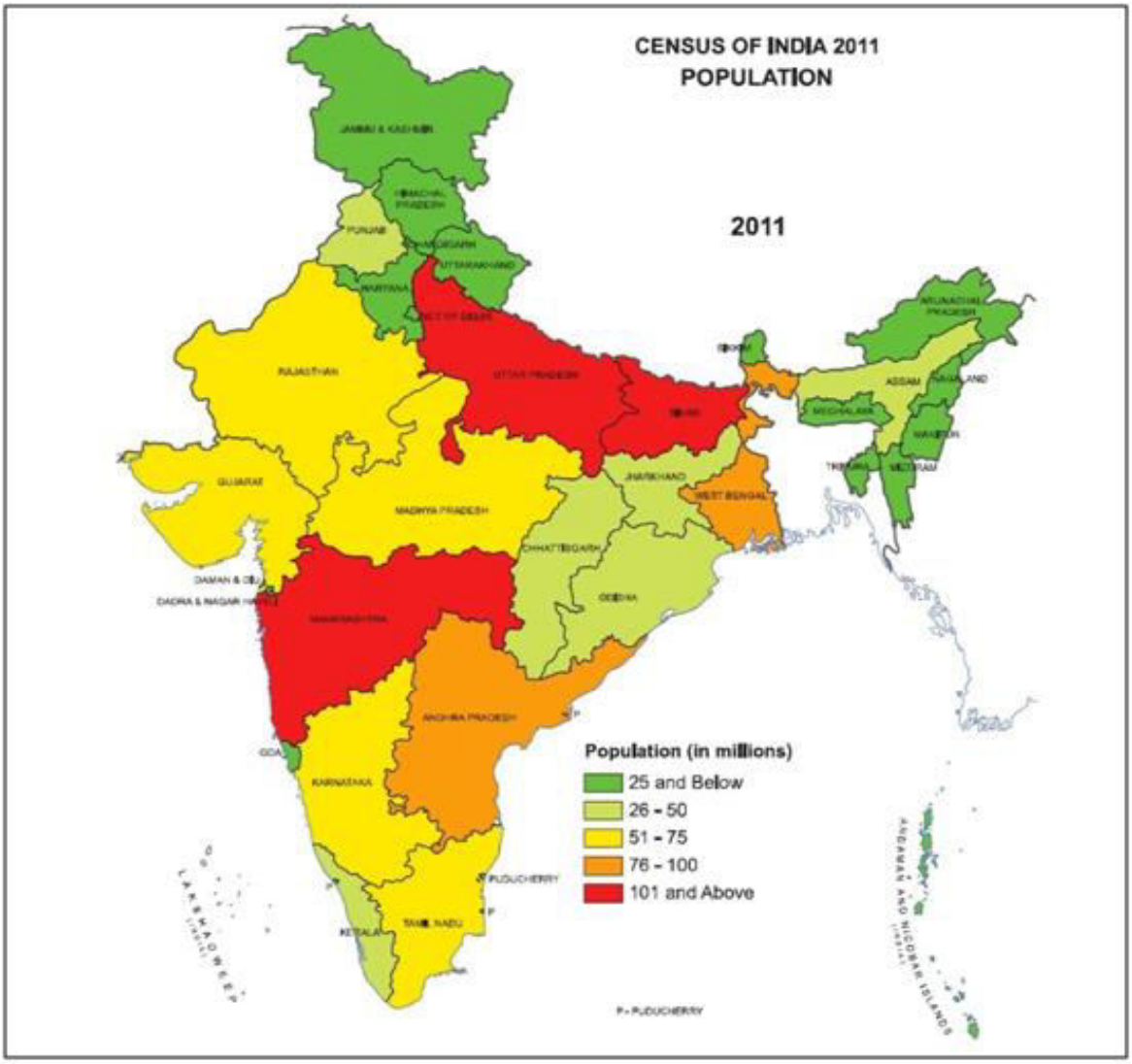
In terms of population, India is the second most populous country in world, only led by People's Republic of China. With a total population of approximately 121 crore (Census 2011), India contributes to about 17% of the total world population. However, this enormous population inhabits only 2.4% area of the world, thereby causing an intense pressure on land and natural resources. This in turn creates a number of economic and social issues such as low standards of living and education, poverty and malnourishment. The ever-increasing population of India is also advancing a threat to the progress of the country, as the poverty and illiteracy rates rise with the rise in population.

In this unit, we present the population profile in India (as per Census of India 2011) by focusing on the population distribution, density, growth and composition. We will also discuss the differences in population trends in rural and urban setting, and the factors that are likely influencing the distribution and growth of population in India.

6.3 DISTRIBUTION OF POPULATION

A number of natural and cultural factors control distribution of Population. Though scholars put more weight on the natural factors, however, scholars *Clarke* and *Zelinsky* maintain that the cultural factors are more significant in determining the concentration and distribution of population in any given region. Furthermore, according to *Clarke and Zelinsky***,** progressive development of the region, which is dependent on economic and social conditions, technologicaldevelopment and government policy, plays a vital role in the distribution of the population.

Fig 6.1:State wise Population distribution in India



Source: Census of India 2011

Table 6.1. State wise Population and Percent Decadal Change

State (U.Ts. denoted by *)	Population (in millions) (2011)	% Decadal Change (2001 - 2011)
INDIA	**1,210,193,422**	**17.64**
Andaman & Nicobar Is. *	379,944	6.68
Andhra Pradesh	84,665,533	11.10
Arunachal Pradesh	1,382,611	25.92
Assam	31,169,272	16.93
Bihar	103,804,637	25.07
Chandigarh *	1,054,686	17.10
Chattishgarh	25,540,196	22.59
Dadra & Nagar Haveli *	342,853	55.50
Daman & Diu *	242,911	53.54
Delhi *	16,753,235	20.96
Goa	1,457,723	8.17
Gujrat	60,383,628	19.17
Haryana	25,353,081	19.90
Himachal Pradesh	6,856,509	12.81
Jammu & Kashmir	12,548,926	23.71
Jharkhand	32,966,238	22.34
Karnataka	61,130,704	15.67
Kerela	33,387,677	4.86
Lakshadweep *	64,429	6.23
Madhya Pradesh	72,597,565	20.30
Maharashtra	112,372,972	15.99
Manipur	2,721,756	18.65
Meghalaya	2,964,007	27.82
Mizoram	1,091,014	22.78
Nagaland	1,980,602	-0.47
Odisha	41,947,358	13.97
Puducherry *	1,244,464	27.72
Punjab	27,704,236	13.73
Rajasthan	68,621,012	21.44
Sikkim	607,688	12.36
Tamil Nadu	72,138,958	15.60
Tripura	3,671,032	14.75
Uttar Pradesh	199,581,477	20.09
Uttarakhand	10,116,752	19.17
West Bengal	91,347,736	13.93

Source: Census of India 2011 (Provisional Population Totals, Paper I of 2011—Series I)

The distribution of population in India is highly unequal. The most populous states are Maharashtra, Uttar Pradesh, Bihar, Andhra Pradesh and West Bengal, and accounts for almost 50% of the population of India. Whereas, the hilly states in the north-east, and the northern states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand account for some of the lowest populations (contributing to only about 4% to the total population of India). The islands of Lakshadweep, Daman and Diu, Dadra and Nagar Haveli are some of least populated states in India.

On the district level, Thane district of Maharashtra has the highest population (approx. 1.11 crore), while Dibang Valley of Arunachal Pradesh is least population consisting of only about 8000 people. City wise, the urban metropolitan cities of Mumbai, Delhi, Bangalore, Hyderabad and Ahmedabad are the top five populous cities. Mumbai and Delhi, both host a population of more than 1 crore. The urbanization factor and the educational factors are the most important factors which play a huge role in this kind of population in these cities. A more progressive and developed area with more opportunities for employment, variety of sources of entertainment and affordable standards of living tends to attract a higher number of population.

6.3.1 POPULATION GROWTH

Though the estimates of population in India are available since late 1700's, the first consensus was undertaken in 1871. Up until l901, the growth rate was very slow, varying between 0.09% and 1.1% per annum. According to the famous American sociologist Kingslay Davis, "India's population remained almost stationary since 1800 at around 125 million for about 50 years. The population recorded at the time of 1881 census exceeded the figure for 1921 by only 1.47 crores." The reason for the slow population growth rate was the increased mortality rate due to famines, plagues and other epidemics.

The population growth rate since 1901-2011 shows 3 distinct phases: stagnant population (1901-1921); steadily increasing population (1921-1951) and rapidly growing population from (1951-2011). The population between 1901-2011 is given Table 6.2.

The stagnant population phase,continued from the 1800's to early 1900's. the population from 1901-1921 witnessed a stagnant population, increasing from about 238 million in 1901 to about 251 million 1921, resulting in an average growth rate of 0.27% per annum. From 1911-1921, there is a decline in the population of approximately 1.2 million, mainly due the very high

mortality rate because of widespread influenza and extensive famines and drought conditions. The year of 1921 is acknowledged as the "Demographic Divide" between the period of stagnant

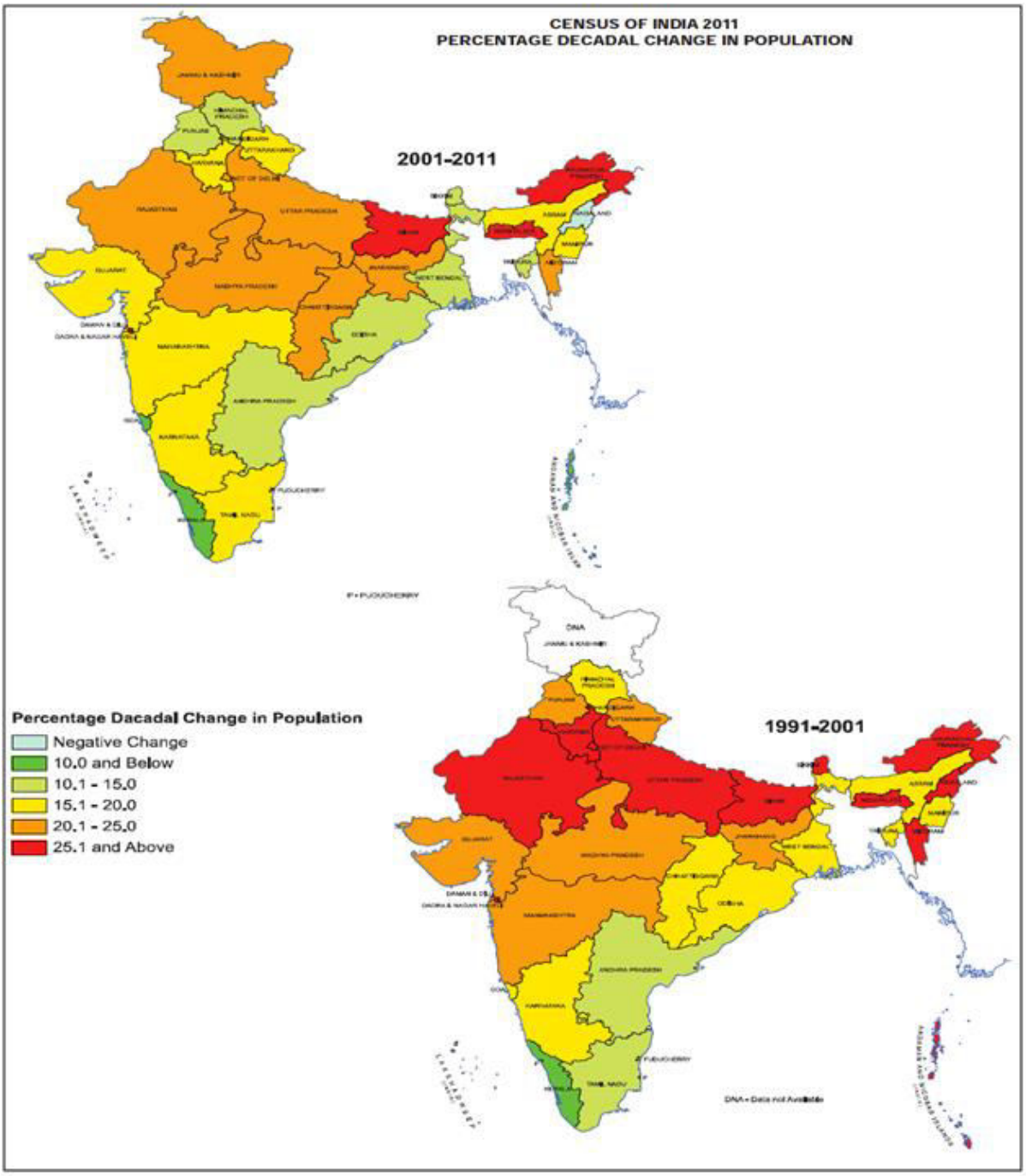
Table 6.2. Growth of Population in India from 1901 to 2011

Year	Population (millions)	Decadal Change (%)	Average Annual Growth rate (%)
1901	238.3	—	—
1911	252.0	+5.75	0.56
1921	251.2	-0.31	-0.03
1931	278.9	+11.00	1.04
1941	318.6	+14.22	1.33
1951	361.0	+13.22	1.25
1961	439.2	+21.51	1.96
1971	548.1	+24.80	2.20
1981	683.3	+24.66	2.22
1991	844.3	+23.50	2.14
2001	1027.0	+21.54	1.97
2011	1210.0	+17.64	1.64

Source: Census of India 2011

or fluctuating growth and the period marked by steady population growth from1921 to 1951, the **steady population growth phase**, the population increased by 43.67% from 251 million to 361 million. The main reason for this change in trend of the populationgrowth was that the improved medical facilities,communication, transportation and food production could arrest the growth of mortality due to famines and other epidemics. In the most recent years,the year 1951 marked yet another "**Demographic Divide"** in the growth history of India's population. At this stage, a tremendous amount of increase was witnessed: the country's population increased by approximately 284% between 1951- 2011.

Fig. 6.2 Growth of Population in India



Source: Census of India

The average annual growth rate by the decades fluctuated between 1.65% and 2.22% per annum. The large scale rapid development, improved medical facilities and increased food

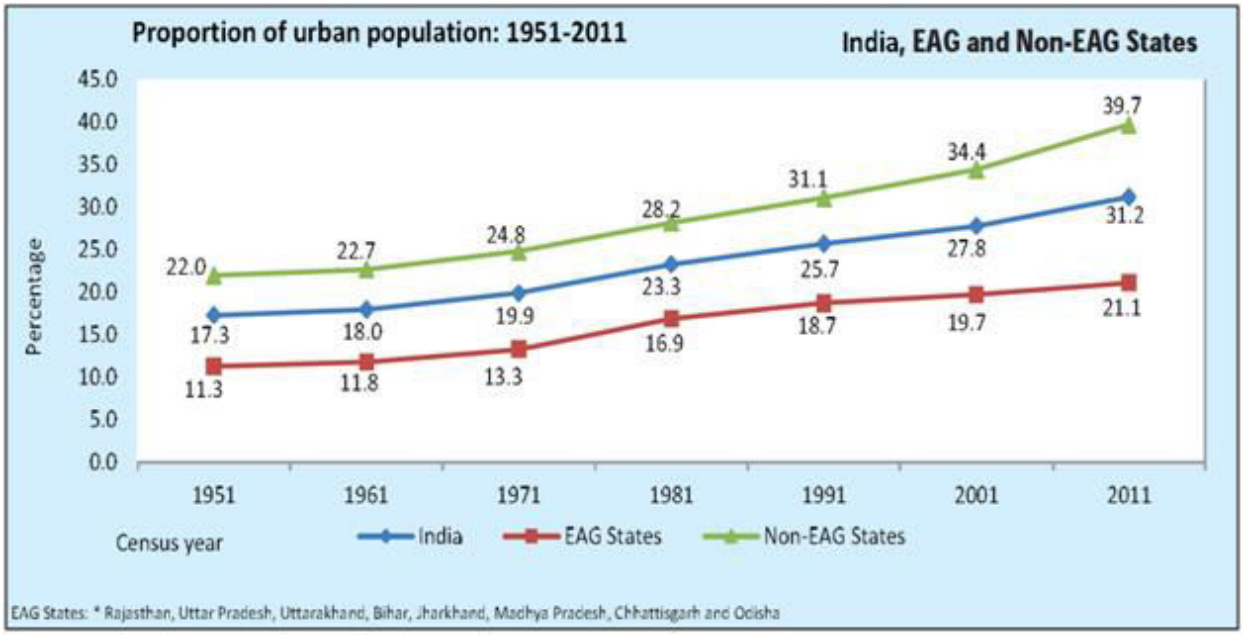
production all contributed to lower the mortality rate, along with increasing the birth rate in India. This primarily caused the population to balloon in the recent history of India.

6.3.2 RURAL URBAN DIFFERENCES

Urbanization is the migration of population from not very well developed rural areas such as villages to well developed urban areas such as cities. This gradual or rapid increase in the proportion of people living in urban areas, cause cities to grow physically as well. This dynamic and evolving nature of the rural-urban makeup of the population reflects the evolution of occupation structure and the state of economy in the nation.

The urban population in 1901 was only about 10.8% of the total population of India, but has been steadily growing from 1951 till present. In the past decade, the urban population hasincreased from 27.8% to 31.2%. Urbanization in India is not very high as compared to other developing countries. For example, in 2001, the rate of urbanization was 40% for developing countries, about 36% for China, and 33 % for Pakistan. Compared to these, India only had about 27.8%.The degree of urbanization is dependent on the ratio of urban population to totalpopulation. States and UT's have been divided into 5 categories based on urbanization (data in Table 6.3):

Fig. 6.3 Urbanization trend in India



Source: Census of India, 2011

i. very high (> 60% urbanization) - Delhi, Chandigarh, Puducherry (examples)

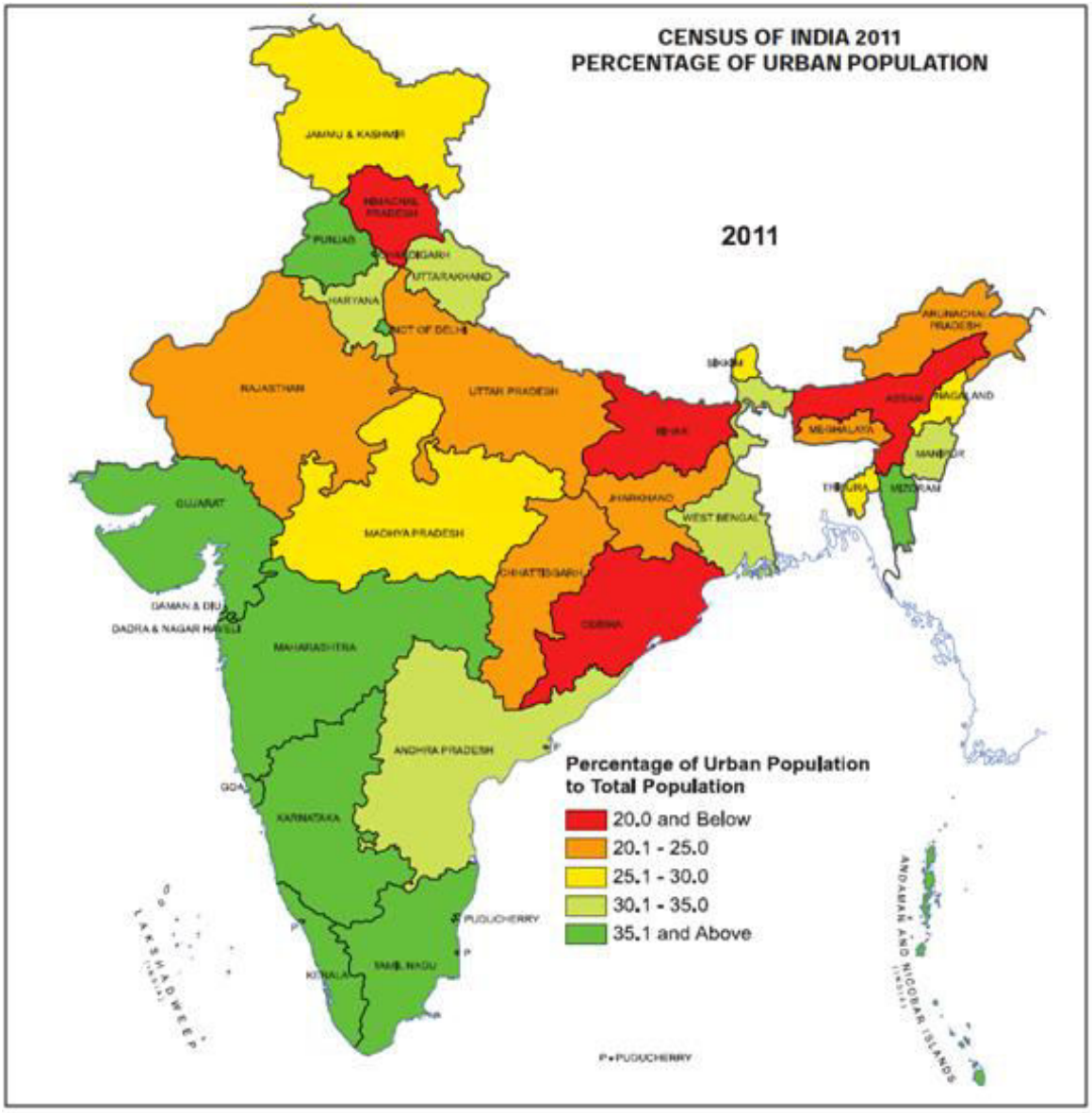
ii. high (40-60%) - Lakshadweep, Goa, Mizoram, Tamil Nadu, Maharashtra

iii. high-medium (30-40%) - Gujarat, Karnataka, Punjab, Haryana, West Bengal, Daman & Diu

iv.low-medium (20-30%) - Andhra Pradesh, Uttar Pradesh, Uttarakhand, Kerala, Chhattisgarh

v. low (< 20 %) - Assam, Bihar, Sikkim, Himachal Pradesh.

Fig. 6.4 Percentage of Urban Population in India



Source: Census of India, 2011

Table 6.3. Degree of Urbanization by States

State (U.Ts. denoted by *)	% Urban Population (2001)	% Urban Population (2011)
INDIA	**27.8**	**31.2**
Andaman & Nicobar Is. *	32.6	37.7
Andhra Pradesh	27.3	33.4
Arunachal Pradesh	20.8	22.9
Assam	12.9	14.1
Bihar	10.5	11.3
Chandigarh *	89.8	97.3
Chattishgarh	20.1	23.2
Dadra & Nagar Haveli *	22.9	46.7
Daman & Diu *	36.2	75.2
Delhi *	93.2	97.5
Goa	49.8	62.2
Gujrat	37.4	42.6
Haryana	28.9	34.9
Himachal Pradesh	9.8	10.0
Jammu & Kashmir	24.8	27.4
Jharkhand	22.2	24.0
Karnataka	34.0	38.7
Kerela	26.0	47.7
Lakshadweep *	44.5	78.1
Madhya Pradesh	26.5	27.6
Maharashtra	42.4	45.2
Manipur	26.6	32.5
Meghalaya	19.6	20.1
Mizoram	49.6	52.1
Nagaland	17.2	28.9
Odisha	15.0	16.7
Puducherry *	66.6	68.3
Punjab	33.9	37.5
Rajasthan	23.4	24.9
Sikkim	11.1	25.2
Tamil Nadu	44.0	48.4
Tripura	17.1	26.2
Uttar Pradesh	20.8	22.3
Uttarakhand	25.7	30.2
West Bengal	28.0	31.9

Source: Primary Census Abstract — Data Highlights, Census of India 2011

6.3.3DENSITY OF POPULATION

Population density is the measure of persons inhabiting a unit area of land. For example, the population density of India in 2011 was calculated to be 382 persons per square km. The density of population can be seen as a measure of the pressure or strain that a population puts on land resources in a country or a nation. Table 6.4 shows that population density of India from 1901 - 2011. Though the absolute increase in the density has becoming more and more over the decades, the percentage increase has slowed downed. The percentage increase climbed sharply in 1921-1931, and continued to grow steadily until 1961, after which it stabilized in low 20%'s. In the most recent decades, from 1991-2011, the percentage increase shows a decline, from 23.6% to 17.5%. Nevertheless, the population density of India is high and is of concern. The high density puts an immense pressure on available land resources, infrastructure facilities, and therefore, adversely affects the quality of life and environment.

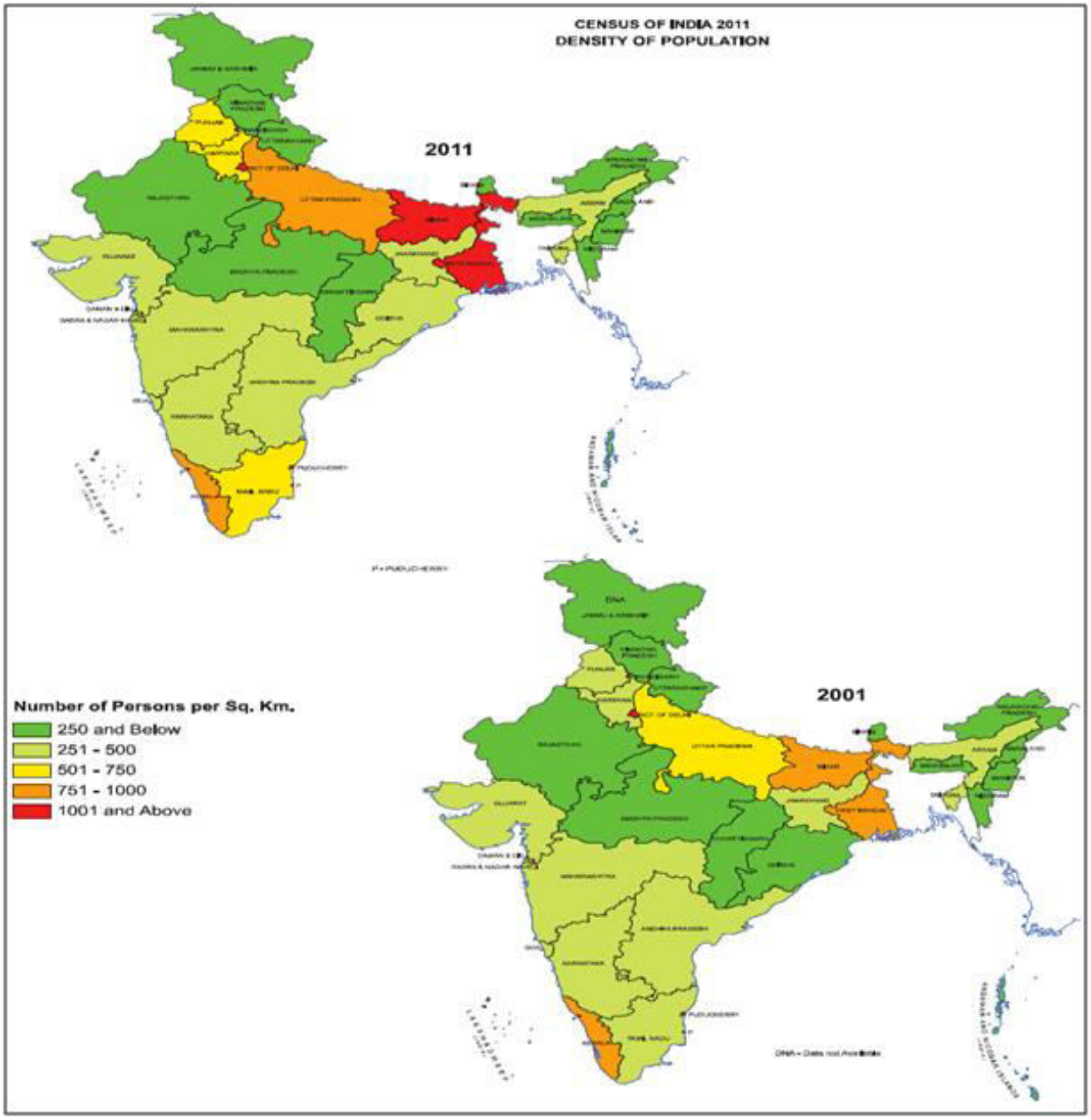
Table 6.4. Density Population (per sq. km) of India (1901 - 2011)

Year	Population Density	Absolute Increase	% Increase
1901	77	—	—
1911	82	5	6.5
1921	81	-1	-1.2
1931	90	9	11.1
1941	103	13	14.4
1951	117	14	13.6
1961	142	25	21.4
1971	177	35	24.6
1981	216	39	22.0
1991	267	51	23.6
2001	325	58	21.7
2011	382	57	17.5

Source: Provisional Population Totals, Paper I of 2011 (Series I)

In India, variation in the spatial pattern of the population density is observed. The population density of each state in 2001 and 2011 is show in Table 6.5 and Density population Maps shown below also serve to distinguish between densely populated areas (Bihar, Delhi, West Bengal) and areas with low population density (Rajasthan, Uttarakhand, Himachal Pradesh).

Fig. 6.5 State wise population density of India



Source: Census of India

Table 6.5. Population Density (per sq. km) by State

State (U.Ts. denoted by *)	2001	2011
INDIA	**352**	**382**
Andaman & Nicobar Is. *	43	46
Andhra Pradesh	277	308
Arunachal Pradesh	13	17
Assam	340	398
Bihar	881	1106
Chandigarh *	7900	9258
Chattishgarh	154	189
Dadra & Nagar Haveli *	449	700
Daman & Diu *	1425	2191
Delhi *	9340	11320
Goa	364	394
Gujrat	258	308
Haryana	478	573
Himachal Pradesh	109	123
Jammu & Kashmir	100	124
Jharkhand	338	414
Karnataka	276	319
Kerela	820	860
Lakshadweep *	2022	2149
Madhya Pradesh	196	236
Maharashtra	315	365
Manipur	97	115
Meghalaya	103	132
Mizoram	42	52
Nagaland	120	119
Odisha	236	270
Puducherry *	1989	2547
Punjab	484	551
Rajasthan	165	200
Sikkim	76	86
Tamil Nadu	480	555
Tripura	305	350
Uttar Pradesh	690	829
Uttarakhand	159	189
West Bengal	903	1028

Source: Primary Census Abstract — Data Highlights, Census of India 2011

6.3.4 FACTORS INFLUENCING DISTRIBUTION OF POPULATION

India, similar to many other developing nations around the world, suffer from over population caused by the rapid population growth rate (approximately 2% per annum) in the recent history of the country, as birth rate continue to tremendously exceed the death rate. The immense population in India is not uniformly distributed and as mentioned in the earlier sections, and distribution of population is controlled by a number of natural and cultural factors. Better employment prospects and higher quality of life leads to difference in the populations of different areas. People migrate to areas offering them a better prospect of life.

Migration is the movement of people from one place to another temporarily of permanently and is composed of four types: rural to rural, rural to urban, urban to rural and urban to urban. Migration to and from any area primarily influences the distribution of the population in the region. The main cause of migration is economic factors, but factors like marriage, social insecurity, political disturbances, and inter ethnic conflicts also contribute to migrations. Social factors such as recreation, health care, education, legal services are also a cause for short time migrations. In the cases of males, the disparity in economic development seems to be the main cause of migration. However, in cases of females, marriage is the main cause of migration.

Migration is a product of the "pull" and "push" factors. When it is caused by the attraction of a city, it is attributed to the "pull" factor. Whereas, factors such as unemployment, hunger, and conflicts that cause migration are the "push" factors. Densely populated rural areas with an increased pressure on land resources contribute to outward migration. In big cities, more employment opportunities, plantation agriculture, and Green revolutions seem to be the major "pull" factors in migrations. Rajasthan, Uttar Pradesh, Bihar, Andhra Pradesh and Kerala are major out-migration states. West Bengal, Maharashtra, Assam, Delhi and Chandigarh are mostly in-migration States and Union Territories.

The distribution of population is also determined by the location of resource regions. **Resource Regions** are the regions that have big industrial ad urban clusters with significant scientific and technological resource potential to attract more population. For examples, resource region such as the West Bengal Deltaic Region has a significant pulling affect over the rural population. The Hugli industrial region, the Damodar industrial region and the Deccan region has also attracted a significant amount of in-migrating population. The growth of various industries, widespread urbanization and development of transport facilities, power, education

quality etc. in cities such as Ahmedabad, Surat, Nagpur, etc. has also attracted populations from neighborhood areas.

Though urbanization and well developed areas tend to attract populations, the populations are turning away from areas with less facilities. For example, the hilly areas of north western Himalayas (Uttarakhand, Himachal Pradesh), eastern hills and plateau and Andaman-Nicobar Islands have rough terrain and poor land resources for practicing agriculture. In addition to that, lack of stable infrastructure have limited the use of other natural resources such as hydro, forest and minerals in these areas. In higher altitudes of these states, the cold temperatures, insufficient food production and meager opportunities for employment further serve as push factors, causing populations to migrate to areas with much favorable living conditions.

All these factors have resulted in a varied distribution pattern of population in India. These factors have led to the most populous states being Maharashtra, Uttar Pradesh, Bihar, Andhra Pradesh and West Bengal, and accounting for almost 50% of the population of India. The unfavorable living conditions for people in the hilly states (Jammu and Kashmir, Himachal Pradesh and Uttarakhand) have led to some of the lowest populations in the country, contributing to only about 4% to the total population of India.

6.3.5 POPULATION COMPOSITION BY AGE, SEX, LITERACY & OCCUPATION STRUCTURE

Population composition refers to the combined demographic characteristics of persons within a country or nation. These characteristics, such as age, sex, and literacy and occupation structure create a profile of the population. Further more, these attributes gives the population, its character: whether it is female-dominated, composed mostly of senior citizens or has a below average literacy rate. Population composition of an area can be useful when predicting the heath service demands, energy consumption and other socio-economic factors. This in turn can be useful while implementing government policies and allotting development funds in the region. Here we present India's demographic based on age, sex, literacy, and occupation structure.

AGE STRUCTURE

The age structure of a population is an important factor in population dynamics and evolution.Age structure is the proportion of a population in different age groups (Table 6.6). Age structureis one of the most important factors in determining the proportion working population availablethat can contribute to the labor force and the dependent population in the total population.Population models that incorporate age structure in its criteria make better prediction ofpopulation growth, plus enhance the ability to associate this growth with the level of economicdevelopment in a region, thereby also aiding in the making of development policies

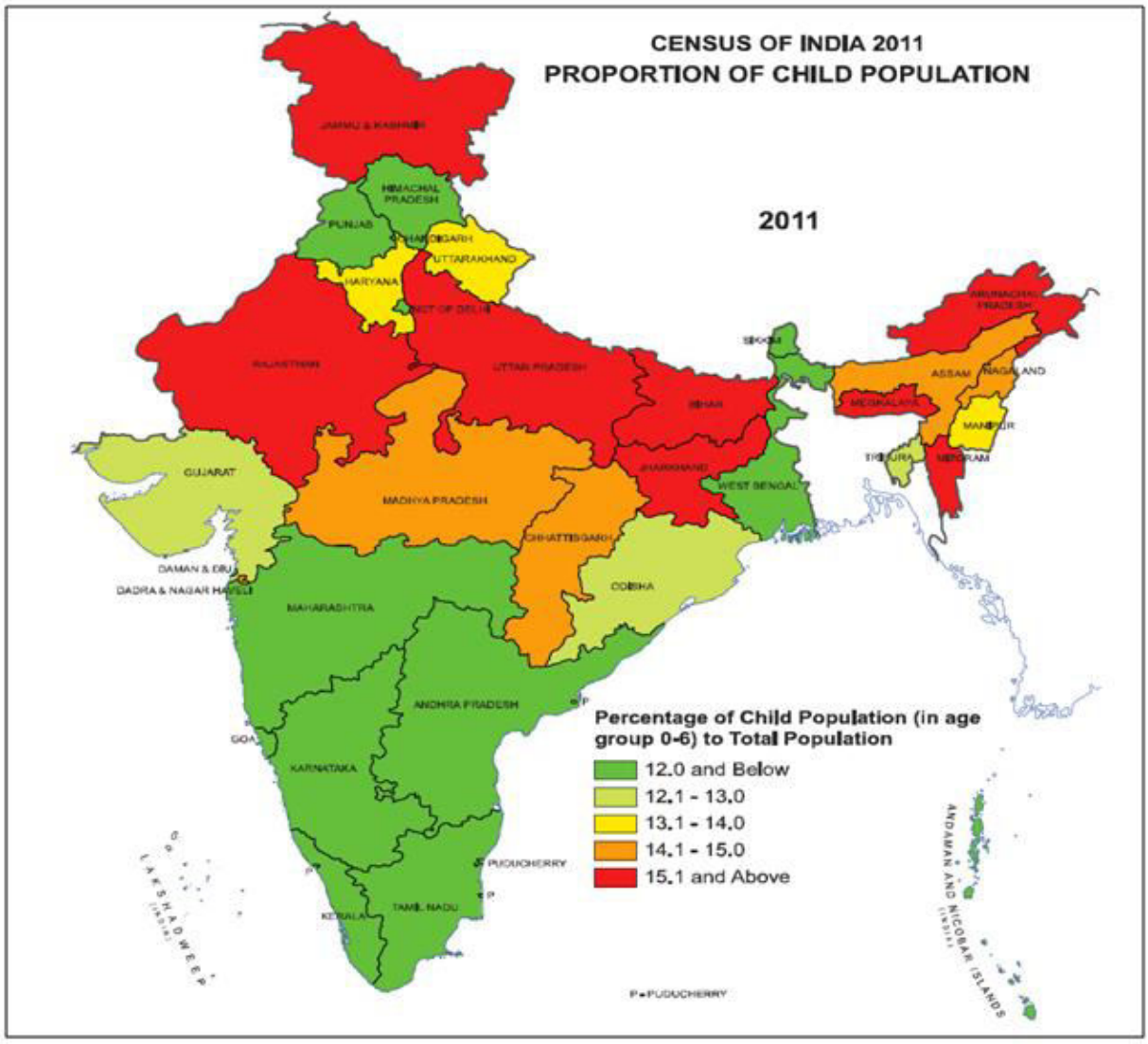
Over the course of history inIndia,the working population (in the age group 15-60) constitutes about 50-55% of the total population of India, the remaining being the dependent population (0-14 age group and 60 & above age group). This is a high dependency ratio and is characteristic of developing countries around the world. There is high percentage (more than 35%) of population in the age group 0-14 years, which can be considered beneficial as this young generation will add to the working population of India in coming decades. The Census of India, 2011 published a special series on the population of children of age 0-6 years. Most of the southern states of Maharashtra, Karnataka, Tamil Nadu & Andhra Pradesh and West Bengal,Delhi, Himachal Pradesh & Punjab has less than 12% of its population who are children (0-6 years old). Whereas in Jammu and Kashmir, Rajasthan, Uttar Pradesh, Jharkhand, Meghalaya and Arunachal Pradesh more than 15% of population is composed of 0-6 age group children.

Table 6.6. Broad Age Groups of Population (% of total population)

Year	0-14 years	15-59 years	60 and above
1901	38.1	56.8	5.1
1911	37.8	56.9	5.2
1921	38.6	56.0	5.4
1931	38.5	56.4	5.1
1941	39.1	55.2	5.7
1951	37.5	56.9	5.6
1961	41.0	53.3	5.6
1971	42.0	52.0	6.0
1981	39.7	54.1	6.2
1991	37.8	55.5	6.7

Source: Census of India, 2001

Fig. 6.6: Percentage of child population between 0-6 years of age.



Source: Census of India

SEX RATIO

Sex ratio can be defined as the number of females per 1000 males. The sex ratio trends in India from 1901 to 2011 are given in Table 6.7. In majority of the time, the trend shows a declining sex ratio (except in 1951, 1981, 2001 and 2011). The preference for male child in India is primarily due to its strong patriarchal nature. This bias against girl child and parental determination of sex have been detrimental for the females in the country. Female infanticides along with the high mortality rate of mothers during child birth have resulted in a reduction in the sex ratio. In 1901 there were 972 females per 1000 males, however, according to the 2011

census, now there are 940 females per 1000 males. Though there has been a decreasing trend in the sex ratios, the sex ratio has been growing since the past three decades. In 1991, the sex ratios were 927 and in 2001 it was 933. Since then it has grown to 940 in 2011.

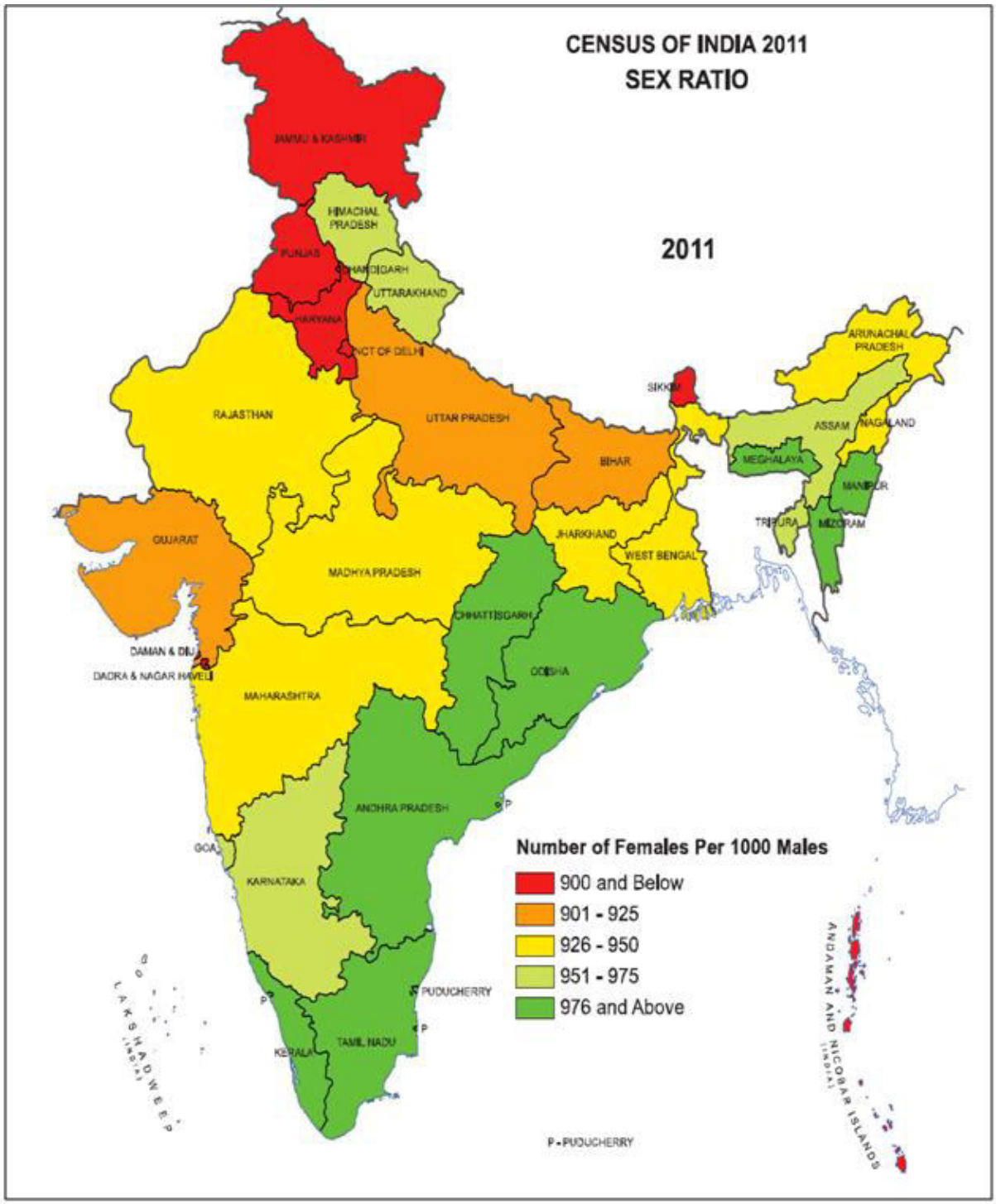
The table below shows the sex ratio by state from Census 2011. The states with low (<900) sex ratios are Jammu and Kashmir, Punjab, Haryana, Delhi, Sikkim and Andaman & Nicobar Islands. The states with high sex ratios (>976) are Kerala, Tamil Nadu, Pondicherry, Odisha, Chhattisgarh, Meghalaya, Manipur, Mizoram and Arunachal Pradesh.

Table 6.7 Trends in sex ratio in India.

Year	No. of Females per 1000 males
1901	972
1911	964
1921	955
1931	950
1941	945
1951	946
1961	941
1971	930
1981	934
1991	927
2001	933
2011	940

Source: Census of India, 2011

Fig. 6.7 Sex Ratio by state.



Source: Census Ratio India 2011

Table 6.8. State wise Sex Ratio (No. of Females per 1000 males)

State (U.Ts. denoted by *)	2001	2011
INDIA	**933**	**940**
Andaman & Nicobar Is. *	846	878
Andhra Pradesh	978	992
Arunachal Pradesh	893	920
Assam	935	954
Bihar	919	916
Chandigarh *	777	818
Chattishgarh	989	991
Dadra & Nagar Haveli *	812	775
Daman & Diu *	710	618
Delhi *	821	866
Goa	961	968
Gujrat	920	918
Haryana	861	877
Himachal Pradesh	970	974
Jammu & Kashmir	892	883
Jharkhand	941	947
Karnataka	965	968
Kerela	1058	1,084
Lakshadweep *	948	946
Madhya Pradesh	919	930
Maharashtra	922	925
Manipur	974	987
Meghalaya	972	986
Mizoram	935	975
Nagaland	900	931
Odisha	972	978
Puducherry *	1,001	1,038
Punjab	876	893
Rajasthan	921	926
Sikkim	875	889
Tamil Nadu	987	995
Tripura	948	961
Uttar Pradesh	962	908
Uttarakhand	898	963
West Bengal	934	947

Source: Primary Census Abstract — Data Highlights. Census of India 2011

LITERACY

The working definition of literacy in the Indian census since 1991 is the total percentage of the population of an area at a particular time aged seven years or above who can read and write with understanding. It is an index of quality of human life and human development. It is representative of economic development, standard of living, status of women and technological advances. Literacy in India in 1901 was merely 5.35%, but has reached to 74.04% in 2011. Still, India has the largest illiterate population in the world, and this poses to be a stumbling block in the development of the country. Though literacy in women has also grown 11 times than it was in 1901 (only 0.60%), it still stagers behind the male literate population.

At state level, Kerala with 93.91% literacy in 2011 has the highest literacy in India, whereas Bihar has the lowest literacy of 63.82%. Table 6.10 shows state-wise literacy in India.

Table 6.9. Literacy (%) trend in India

Year	Total	Male	Female
1901	5.35	9.83	0.60
1911	5.92	10.56	1.05
1921	7.16	12.21	1.81
1931	9.50	15.59	2.93
1941	16.10	24.06	7.30
1951	18.33	27.16	8.86
1961	28.31	40.40	15.34
1971	34.45	45.95	21.97
1981	43.56	56.37	29.75
1991	52.21	64.13	39.29
2001	65.38	75.85	54.16
2011	74.04	82.14	65.46

Source:Census of India, 2011

Table 6.10. State wise Literacy Rate

State (U.Ts. denoted by *)	2001	2011	Decadal increase %
INDIA	**64.83**	**74.04**	**9.21**
Andaman & Nicobar Is. *	81.30	86.27	4.97
Andhra Pradesh	66.64	67.66	8.96
Arunachal Pradesh	53.34	66.95	12.61
Assam	63.25	73.18	9.93
Bihar	47.00	63.82	16.82
Chandigarh *	81.94	86.43	4.49
Chattishgarh	64.66	71.04	6.38
Dadra & Nagar Haveli *	57.63	77.65	20.02
Daman & Diu *	78.18	87.07	8.89
Delhi *	81.87	86.34	4.67
Goa	82.01	87.40	5.39
Gujrat	69.14	79.31	10.71
Haryana	67.91	76.64	8.73
Himachal Pradesh	76.48	83.78	7.30
Jammu & Kashmir	55.52	68.74	13.22
Jharkhand	53.56	67.63	14.07
Karnataka	60.47	75.60	7.19
Kerela	90.86	93.91	3.05
Lakshadweep *	86.66	92.28	5.62
Madhya Pradesh	63.74	70.63	6.98
Maharashtra	76.88	82.91	6.03
Manipur	69.93	79.85	9.92
Meghalaya	62.56	75.48	12.92
Mizoram	88.80	91.58	2.78
Nagaland	66.59	80.11	13.52
Odisha	63.08	73.45	10.37
Puducherry *	81.24	86.55	5.31
Punjab	69.65	76.68	7.03
Rajasthan	60.41	67.06	6.65
Sikkim	68.81	82.20	13.39
Tamil Nadu	73.45	80.33	6.88
Tripura	73.19	87.75	14.56
Uttar Pradesh	71.62	79.63	8.08
Uttarakhand	56.27	69.72	13.45
West Bengal	68.64	77.08	8.44

Source: Census of India 2011

OCCUPATION STRUCTURE

The rate of growth in workforce is 1.8% between 2001 and 2011 and though it is observed to be marginally higher than that of the population growth rate; this rate is lower than that of previous two decades (1980s and 1990s). However, the rate of growth in workforce has always been higher than that of population growth during the last three decades, suggesting an increase in work participation rate.

Nearly 67% of the working population in primary sector (agriculture and similar activities) and only 12% in secondary and 13% tertiary sector. There has been a small decline in the primary workforce from 1911 to 1991 (7.8%). This is indicative of slow economic growth, a heavy dependence on agriculture and insufficient employment opportunities in secondary sector.

A significant characteristic of the Indian occupation structure is the low participation of females in the working population of India. Females contribute to only about 22.5% in the country's total working population and majority of them are in agriculture. Furthermore, more female workers work as marginal employees than male workers. Census classifies workers into two categories— main and marginal workers. The main workers work for more than six months in a year and the marginal workers work for less than six months. Therefore, more females work in temporary or short term jobs. While 55.5% of the population is in the working age group (15-59 age group), only about 34% of the population is counted towards a working population, showing that a significant amount of the country's manpower is not utilized.

Table-6.11: Working population of India.

Year	Population (in millions)			Working Pop. (millions)			% of Marginal Workers		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
1981	685.2	330.8	354.4	244.6	63.5	181.1	9.0	29.2	2.0
1991	846.3	407.1	439.2	314.1	89.5	224.4	9.0	28.4	1.2
2001	1028.6	496.5	532.2	402.5	127.0	275.5	22.4	42.9	13.0
2011	1210.2	586.5	623.7	481.7	149.9	331.9	24.8	40.4	17.7

Source:Census of India, 2011

6.4 SUMMARY

The population of India is diverse and contributes to 17% of the total world population. As of 2011, only 74.04 % of the population is literate and 34% is in the work force. Though their has been a tremendous increases in literacy and occupation, the country still hosts the largest population of the illiterates in the world. The sex ratio of India is 940 and Though there has been a decreasing trend in the sex ratios, it has been growing since the past three decades, which is a positive sign. However, biases against women in the country continue to hinder their development, which is also evident in the occupation structure: most females work as marginal workers and number of female workers is significantly less than the male workers. Urbanization continues to pull population into better-developed areas, thereby increasing population density in those areas. The hilly states with less favorable conditions for human inhabitance continue causes migration of population into areas with more opportunities and a better quality life.

6.5 GLOSSARY

Age structure is the proportion of a population in different age groups. Age structure is one of the most important factors in determining the proportion working population available that can contribute to the labor force and the dependent population in the total population.

Demographic Divide: The year of 1921 is acknowledged as the "Demographic Divide" between the period of stagnant or fluctuating growth and the period marked by steady population growth. The year 1951 marked yet another "Demographic Divide" in the growth history of India's population. At this stage, a tremendous amount of increase was witnessed: the country's population increased by approximately 284% between 1951- 2011.

Literacy: The working definition of literacy in the Indian census since 1991 is the total percentage of the population of an area at a particular time aged seven years or above who can read and write with understanding. It is an index of quality of human life and human development. It is representative of economic development, standard of living, status of women and technological advances.

Main and Marginal workers: Census classifies workers into two categories— main and marginal workers. The main workers work for more than six months in a year and the marginal workers work for less than six months.

Migration is the movement of people from one place to another temporarily of permanently and is composed of four types: rural to rural, rural to urban, urban to rural and urban to urban. Migration to and from any area primarily influences the distribution of the population in the region. The main cause of migration is economic factors, but factors like marriage, social insecurity, political disturbances, and inter ethnic conflicts also contribute to migrations.

Population density is the measure of persons inhabiting a unit area of land. For example, the population density of India in 2011 was calculated to be 382 persons per square km.

Resource Regions are the regions that have big industrial ad urban clusters with significant scientific and technological resource potential to attract more population. For examples, resource region such as the West Bengal Deltaic Region has a significant pulling affect over the rural population.

Sex ratio can be defined as the number of females per 1000 males.

Stagnant population phase, continued from the 1800's into early 1900's. the population from 1901-1921 witnessed a stagnant population, increasing from about 238 million in 1901 to about 251 million 1921, resulting in an average growth rate of 0.27% per annum.

Urbanization is the migration of population from not very well developed rural areas such as villages to well developed urban areas such as cities. This gradual or rapid increase in the proportion of people living in urban areas, cause cities to grow physically as well.

6.6 ANSWER TO CHECK YOUR PROGRESS

1. Population distribution refers to how people are spread across a geographical area.
2. Population density is the number of people living in a given area, usually expressed per square kilometer or square mile.
3. Population growth can be influenced by factors such as birth rates, death rates, immigration, and emigration.
4. The sex ratio is a measure of the balance between males and females in a population.
5. In many countries, there is a slightly higher proportion of females compared to males.
6. Literacy rates measure the percentage of people in a population who can read and write at a basic level.
7. High literacy rates are often associated with better economic and social development.

8. Population composition can refer to various demographic factors such as age, ethnicity, and religion.
9. Aging populations have a higher proportion of elderly individuals, which can impact healthcare and social services.
10. Urban areas tend to have higher population densities compared to rural areas.
11. Some countries have negative population growth due to low birth rates and emigration.
12. Developing countries often experience faster population growth compared to developed nations.
13. In many regions, efforts are made to improve female literacy and reduce gender disparities.
14. Population data is essential for governments and policymakers to plan for services and infrastructure.

6.7 REFERENCES

1. Census of India: 1961,1971,1981,1991,2001,2011
1. Registrar General, 2001: Census of India, 2001, India, 2A, Mansingh Road, New Delhi110011, 25th July, 2001
2. Gautam, (2015) "Advanced Geography of India", Fourth Revised Edition, Allahabad.
3. Despande, S.andDespande, L. (1998) " Impact of Liberalisation of Labour Market in India: What Do Facts from NSSO's 50th Round Show" Economic and Political Weekly, Vol.33No 22, pp L21-L31
4. Singh, R.L. (1973); Urban Geography in Developing Countries. NGSI: Varanasi
5. Kundu, A (1983): "Theories of City Size Distribution and Indian Urban Structure – A Reappraisal", Economic and Political weekly, 18(3).
6. Mishra, R.P. and K. Mishra (1988); Million Cities in India. New Delhi
7. M. Venkatanarayana and Suresh V. Naik, Growth and Structure of Workforce in India : An Analysis of Census 2011 Data

6.8 TERMINAL QUESTIONS

A- LONG QUESTIONS

1. Write about the Literacy profile of India taking into account the male and female populations.
2. Describe the factors involved in the distribution of Population.
3. What are the major "pull" and "push" factors that are responsible for migration?
4. What trends are present in the growth of population from 1901 to 2011? Why was there a "stagnant" phase?
5. Comment on the urbanization in India and how has it influenced the population distribution?
6. What is the occupation structure of India? What does the latest data show regarding male and female participation in the working force of India?
7. Which are the most populous and the least populous states?
8. Why is the year 1921 referred to as the "Demographic Divide"?
9. What are resource regions? Why do they attract more population?
10. What was the stagnant population phase in the population growth history of India?
11. Which age group is considered the "working force" and which is considered "dependable"?
12. What is urbanization?
13. What is migration? What is meant by "push" and “pull" factors?
14. Which states have the highest and the lowest sex ratio?
15. Which state has the highest literacy and how much?
16. What is the difference between "main" and "marginal" worker?

B- SHORT QUESTIONS

1. Define the term population distribution. How the population of India is distributed?
2. What is population density? Present an overview of India’s population density.
3. Describe the population growth of India.
4. What is Urbanization? How India’s population is urbanizing?
5. Why India’s average sex ratio is decreasing? Explain
6. Explain the literacy rate of India as per 2011 census.
7. What is main reason behind the faster population growth in India?

C- MULTIPLE CHOICE QUESTIONS

1. Which age group constitutes the largest portion of India's population?

(A) 0-14 years

(B) 15-24 years

(C) 25-54 years

(D) 55+ years

Answer: (A) 0-14 years

2. Which state in India has the highest female literacy rate?

(A) Kerala

(B) Bihar

(C) Uttar Pradesh

(D) Rajasthan

Answer: (A) Kerala

3. What is the term used to describe the movement of people from rural areas to urban

areas?

a) Urbanization

b) Migration

c) Industrialization

d) Ruralization

Answer: b) Migration

4. Which city is often referred to as the "Financial Capital of India& quote; and has significantpopulation?

(A) Mumbai

(B) Delhi

(C) Bangalore

(D) Chennai

Answer: (A) Mumbai

5. What is the main reason for the high population growth rate in India?

(A) Increased life expectancy

(B) Improved healthcare

(C) High birth rate

(D) Declining fertility rate

Answer: (C) High birth rate

6. Which state has the highest population growth rate among the major Indian states?

(A) Bihar

(B) Uttar Pradesh

(C) Madhya Pradesh

(D) Rajasthan

Answer: (A) Bihar

7. What is the name of the government program initiated to control India's populationGrowth through family planning and reproductive health services?

(A) Swachh Bharat Abhiyan

(B) Make in India

(C) Beti Bachao, Beti Padhao

(D) Family Planning Program

Answer: (D) Family Planning Program

8. State with highest population density is

(A) Uttar Pradesh

(B) Bihar

(C) West Bengal

(D) Haryana

Answer: (B) Bihar

9. As per census of 2011, what is the density of India?

(A) 302

(B) 402

(C) 382

(D) 482

Answer: (C) 382

10. During which decade the populations record a negative growth rate?

(A) 1921-1931

(B) 1911- 1921

(C) 1931- 1941

(D) 1941- 1951

Answer: (B) 1911-1921

11. The largest population of Scheduled Tribe is in

(A) Haryana

(B) Kerala

(C) Delhi

(D) Madhya Pradesh

Answer: (D) Madhya Pradesh

12. As per census of 2011, which state has lowest population in India?

(A) Uttar Pradesh

(B) Tripura

(C) Sikkim

(D) Assam

Answer: (C)sikkim

13. What is the approximate population of India as of 2021?

(A) 750 million

(B) 1 billion

(C) 1.3 billion

(D) 2 billion

Answer: (D) 1.3 billion

14. According to census 2011, which Indian state has the highest population density?

(A) Uttar Pradesh

(B) Maharashtra

(C) Bihar

(D) West Bengal

Answer: (C) Bihar

15. Which geographic region of India has the lowest population density?

(A) Northern Plains

(B) Western Ghats

(C) Thar Desert

(D) Eastern Coastal Plains

Answer: (C) Thar Desert

16. What is the approximate annual population growth rate of India?

(A) 0.5%

(B) 1%

(C) 1.5%

(D) 2%

Answer: (D) 2%

UNIT 7- URBANIZATION AND ITS TRENDS

7.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Understand the concept of Urbanization
- Give overview of trends of urbanization in India.
- Explain pattern of urbanization in India
- Look into problems and solution of urbanization in India

7.2 INTRODUCTION

Urbanization is no longer a phenomenon peculiar only to certain parts of the world rather it is a worldwide phenomenon. According to 2001 census, the urban population of the country was 286.11 million, living in 5161 towns, which constitutes 27.81% of the total country's population. However, the same as per 2011 census has risen to 377.16 million viz. 32.16% of the total country's population and at the same time number of towns has gone up to 7935. The rate of urban growth in the country is very high as compared to developed countries, and the large cities are becoming larger mostly due to continuous migration of population to these cities. India's current urban population exceeds the whole population of the United States, the world's third largest country. By 2050, over half of India's population is expected to be urban dwellers. This creates enormous pressure on existing urban infrastructure. Over the years, there has been continuous concentration of population in class I towns. On the contrary the concentration of population in medium and small towns either fluctuated or declined. The graduation of number of urban centers from lower population size categories to class I cities has resulted top heavy structure of urban population in India indicating the tendency towards concentration in larger agglomerations. Urban agglomeration is a continuous urban spread constituting a town and its adjoining urban out growths (OGs) or two or more physical contiguous town together and any adjoining urban out growths of such towns. Examples of out growths are railway colonies, university campus, port area, military campus, etc. that may come up near a statutory town or city. Therefore India's urbanization is often termed as over-urbanization, pseudo-urbanization. The large population size is leading to virtual collapse in the urban services and followed by basic problems in the field of housing, slum, water, infrastructure, quality of life, etc.

7.3 URBANIZATION AND ITS TRENDS

It explains the chief form of the condition of life. It represents a revolutionary change in the whole pattern of social life. A number of scholar forwarded their views on this issue. Queen and Carpenter have said that, "the word urban is used to identify the phenomena of city". Wirth says, that 'urbanism denotes the way of life'.

Urbanization is important event of modern times. The high growth in population of town and high increase in the number of towns are the main features of the modern period. According to G. T. Trewartha, the level of urbanization is defined as the proportion of total population, residing in urban places. However, the rate of urbanization is the percent increase over a given period of time in the proportion of total population living in urban communities.

According to E.E. Bergel, "the conversion of village into urban areas is known as the process of urbanization".

Fig. 7.1: Urbanization in Indian Cities.

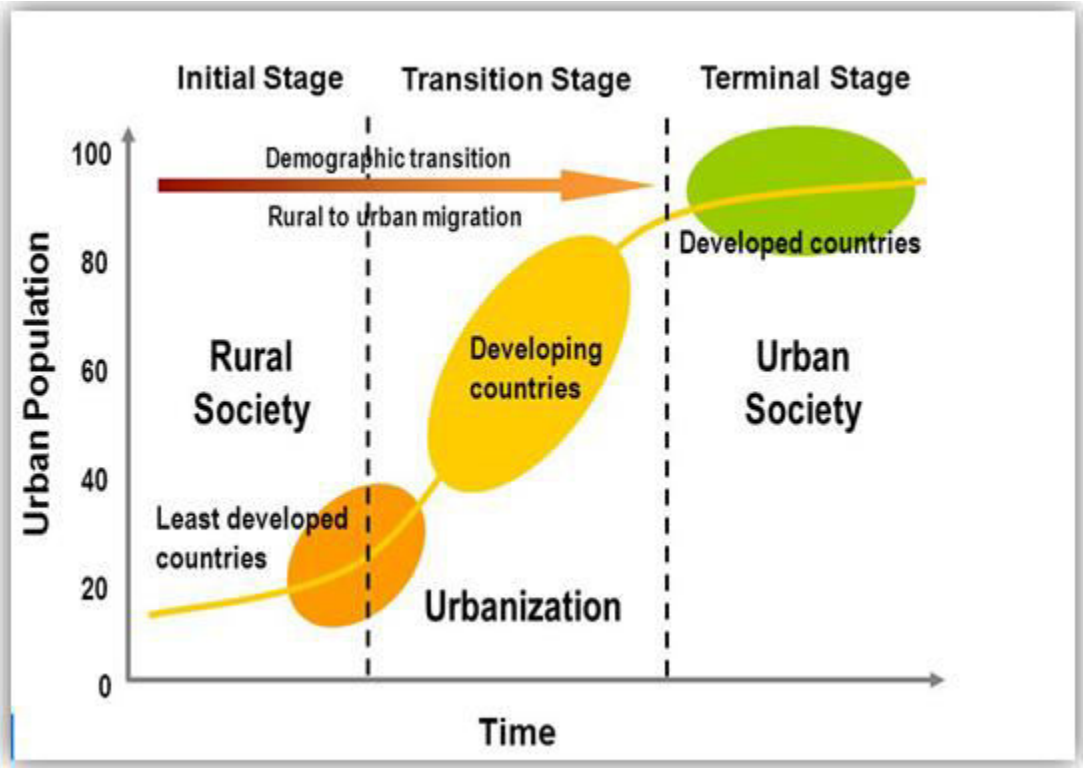
It is apparent from the above definitions that urbanization is not static, but it is dynamic. The speed of urbanization is affected by the economy of an area. This economy speed up towards agricultural economy, it is also accelerates the urbanization. The increase in the

population of towns takes place and also there are continuous increases in their number and also at the same time the ratios of urban population also increase in total population.

7.4.1 CYCLE OF URBANIZATION

G. T. Trewartha says that urbanization is a cyclical process through with nations pass as they evolve from agrarian to industrial societies. Urban process denotes the increase in ratio or urban population to total population. This increase, if it begins, then it also becomes still at certain point. In developed nation of the world, the urbanization took rapid speed in the first hundreds years. Some nations noted fall in this ratio. Thus, the urbanization curve has the shape of an attenuated 'S'. Different nations and regions reach at different points on the curve at different times.

Fig.7.2: Cycle of Urbanization with Different Stages.



I. First stage of urbanization (initial stage): The flattish, lower end of the curve depicts the conditions of an early time period, and is called initial stage of urbanization. It has the slow rise in the ratio of urban population to total population. This ratio is found upto 25%. This line has low steepness. It is characterized by an economic structure known as the traditional society.

The emphasis here is on agrarian sector of the economy, which has characteristically been accompanied by a dispersed population, a relatively small share of which resides in cities. In this initial stage of urbanization, the following nations can be put into this group- Uganda, Tanzania, Sudan, Ethiopia, Kenya, Mauritania, Zambia, Madagascar, Nepal, Bangladesh, Indonesia, Thailand, Malaysia, Pakistan etc.

II. Second Stage of Urbanization (Acceleration Stage): The attenuated trunk of the urbanization curve is referred to as the acceleration. This stage shows the steepness of urbanization. The curve line is just like a vertical line. The steepness goes up to 75% population being urban. During this stage, there is a concentration not only on people but of economic activities as well. Manufacturing industries, trade and services employ increasingly large number of people and become more significant. On the other hand the opportunity of employment declines in the primary sector that includes agriculture. A number of nations of Europe, Asia, South America and South-west Asia have reached in the acceleration stage of urbanization.

III. Third Stage of Urbanization (Terminal Stage): This stage denotes the beginning of the share of urban population 75 percent or more. Hence, the curve line finishes its steepness. Sometimes, this line shows a bend; otherwise it is a flattish urban curve. England in 1861, Belgium in 1910 and Sweden in 1920 have attained the position of flattish urban curve. Here the rate of urbanization becomes very slow. The urbanization has reached up to its last limit in Sweden, Belgium, Israel, Australia and New Zealand. More than 80 percent populations of these nations live in cities.

7.3.2 URBANIZATION IN INDIA

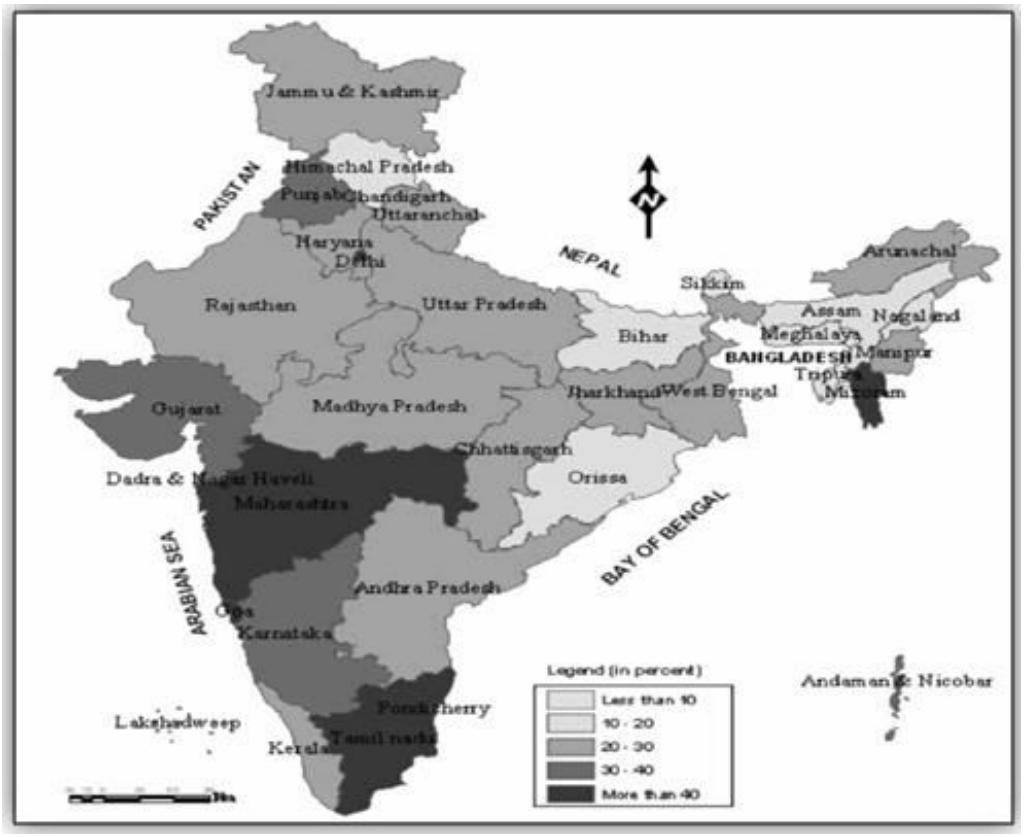
The study of urbanization in India by its very nature involves several dimension of analysis. Fundamentally, urbanization is a socio-economic process by which an increasing proportion of an area becomes concentrated in urban areas. India is the most populous country in the world after China. India's fast growing urbanization has a regional as well as world-wide impact. India's urban population constitutes a sizeable proportion of the world's urban population. This can be well corroborated from the fact that every 12^{th} city dweller of the world and every 7^{th} of the developing countries is the Indian. India has as many small towns (population 100,000-

499,999) as in the United States; and as many metropolises (population +500,000) as in Australia, France and Brazil combined.

Urbanization in India can be studied through Census data provided at a regular interval of 10 years since 1881 onwards. These data help us in analyzing the trends of growth in the urban population, decennial increase, urbanization and number of towns during the 20th century.

The growth of urbanization in India is basically through two ways, one is through increase in the urban population, which is natural and the second one is through migration, which is result of people migrating from rural to urban areas and also from small towns/cities to big metros. However, in 1990s, i.e. when the Indian government opened up their economy, there seen a rise in rapid economic growth of the country. But this economic growth was more of urban growth, which led to rapid migration of rural population to urban areas.

Fig.7. 3: Spatial Pattern of Urbanization in India.



In the year 1951, only five cities were having population of more than one million, which increased to 53 cities in 2011 and it was estimated that by 2031, it will be to 70 cities in the

country with million populations. Similarly, three cities are having more than 10 million populations in the year 2011, and it was estimated that six cities will be having 10 million populations by 2031. Thus, it was estimated that the total urban population by the year 2030 will be 610 million, which will account for the 40% of the total population of the country (Mohan, 2012). The many cities in our country, are becoming extremely crowded and if we see the 20 most densely populated cities in the world, out of which five will be from India including, Kolkata and Mumbai (Confederation of Indian Industry, 2010).

As per the World Urbanization Prospects: 2011 Revision, the percentage of total urban population in India is 30.9 in 2010, which is lower than the developed countries like the United States of America (82.1 per cent) and Japan (90.5 percent) during the same year. It is also lower than in other fast growing developing countries, such as, China (49.2 per cent), Brazil (84.3), and Russian Federation (73.7 per cent) in 2010. India's urban population is mainly concentrated in and around class I cities. The percentage share of urban population in class I cities has increased from 51.42 in 1961 to 68.7 in 2001. On the other hand, classes II to VI cities have registered a decreasing rate of urban population growth (percentage). For instance, the percentage share of urban population in class IV cities decreased from 12.77 in 1961 to 6.84 in 2001.

7.3.3 PHASES OF URBANIZATION IN INDIA

According to Census of India, 2001, nearly 286.12 million people in country live in urban places constituting about 27.8 percent of total population. On the basis of trends of urbanization in India during the 20th century, following three distinct phases may be identified.

1. **Period of Slow Urbanization (1901-31):** In the beginning of twentieth century (1901), the urban population of India was 25.85 million forming 1084 percent of total population. The growth rate of urban population during first and second decades was amazingly low being only 0.35 percent and 8.27 percent respectively. The growth has been steady till 1931 but after that the urban population showed an explosive growth. The decadal growth rate in India's urban population in third decades was recorded as 19.21 percent. In 1931, about 3346 million people forming 11.99 percent of total population of the country lived in 2049 urban places.

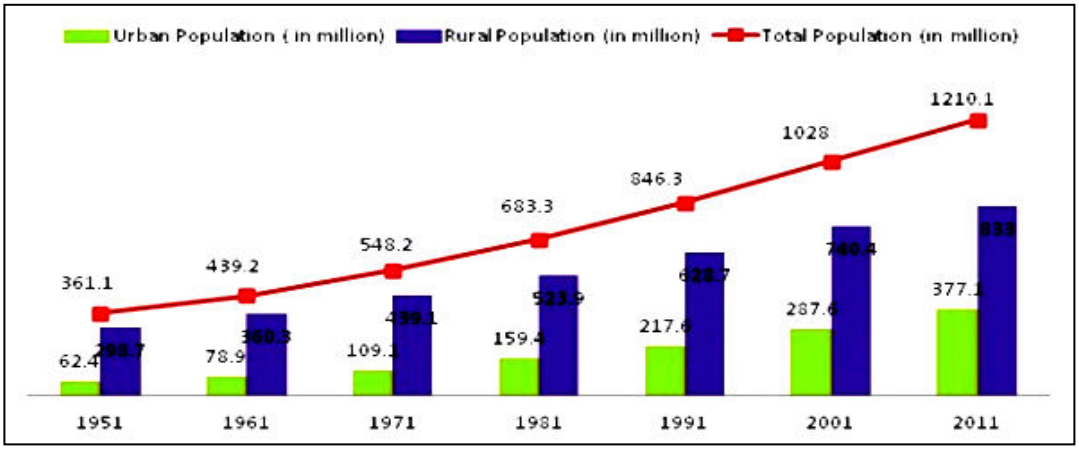
Table 7.1: Growth of Urbanization in India since 1901

Year	Number of Towns	Total urban population (million)	Decadal Variation (percent)	Percentage of urban to total population
1901	1834	25.85	-	10.84
1911	1776	25.94	0.35	10.29
1921	1921	28.09	8.27	11.71
1931	2049	33.46	19.12	11.99
1941	2210	44.13	31.97	13.86
1951	2844	62.44	41.43	17.29
1961	2330	78.94	26.61	17.97
1971	2531	109.11	38.23	19.91
1981	3245	159.46	46.61	23.13
1991	3609	217.61	36.47	26.13
2001	3799	286.12	31.48	27.81
2011	4041	377.11	31.80	31.16

Source: Census of India, 1991 to 2011

2. Period of Medium Urbanization (1931-61): The period between 1931 and 1961 may be considered as a period of medium urbanization in India. The year shows a significant demographic divide in the history of urban growth in the county. In 1931 urban population of the country was 33.46 million which rose to 44.15 million in 1941, 62.44 million in 1951 and 78.94 million in 1961. Thus, the percentage of urban to total population rose from 11.99 percent in 1931 to 17.97 percent in 1961. The decadal variation was recorded as 31.97, 41.43 and 26.41 during fourth, fifth and sixth decades respectively.

Fig.7.4: Growth of urban population in India since 1951 to 2011



The number of towns which was 2049 in 1931 became 2330 in 1961. It is noteworthy that a number of small towns were de-classified from the list of towns in 1961 census because of more strict definition of town adopted by Census of India.

3. Period of Rapid Urbanization (1961-1991): The urban development in India got momentum after 1961 due to the stabilization of the economic development and industrialization growth. Consequently, the urban population of the country increased from 78.94 million in 1961 to 286.12 million in 2001 showing a growth of 262.0 percent during 40 years. The percentage of urban population to total population which was 17.97 percent reached 23.31 percent in 1981 and 27.81 percent in 2001. Similarly, number of towns and cities rose from 2330 in 1961 to 4041 in 2011. It is marked that, here the urban agglomeration is treated as one unit otherwise number of towns comes to be 7935.

Table 7. 2: Phases of Urbanization in India

S. No.	Stages of Growth	Period	Growth in Urban Population (in million)	Growth Rate	Changes in Percentage of Urban Population	Number of Town increased in the Period
1.	Slow	1901-1931	8.10	31.51	10-12	215
2.	Medium	1931-1961	45.00	133.14	12-18	281
3.	High	1961-1991	183.40	175.63	18-25	1279
4.	Very High	1991-2011	159.90	73.62	25-31	4326
Total Change		**1901-2011**	**+351.40**	**-**	**21.15**	**6101**

Source: Census of India

4. Period of High Rapid Urbanization (1991-till now): During these decades, 159.9 million urban populations were added. This addition is just equivalent to the urban population of 1981. The percentage of urban population was increased from 25.72 to 31.61 percent. This period noted as an addition of 4326 new towns. It is clear that a number of villages are proceeding towards urbanization. It is also observed that metropolitan cities are making impressive increase

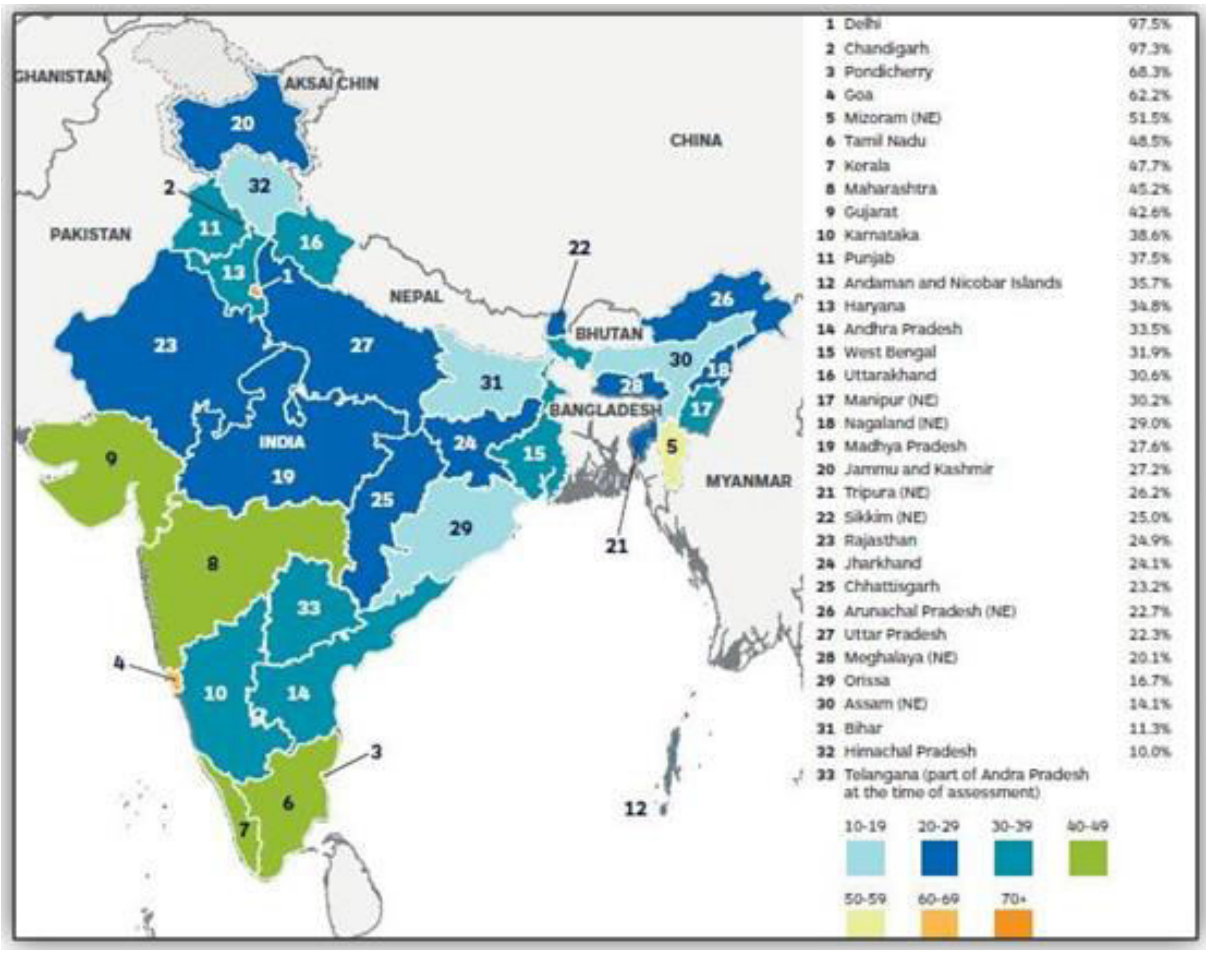
in their population size. These were 23 in number in 1991, but this number touched the figure of 53 in 2011.

7.3.4 SPATIAL PATTERN OF LEVEL OF URBANIZATION

I. Urban Population Ratio: People living in towns and urban agglomerations with a population of 20,000 or more accounted for 20.5 percent of India's total population of 683 million in 1981. In relation to developed countries this represents a low level of urbanization. While no country in the world has the whole of its population in towns of 20,000 or more, a number of countries have over 60 per cent of their population living in such places. The percentage of population living in urban centers in India is increasing at an annual rate of approximately 2 percent. In 1971, the percentage of population in 20,000-plus towns was 16.1 and there was a 25 per cent increase during the decade 1971-81. While the percentage will continue to increase in the future, it may not reach the level prevalent in developed countries for decades to come.

There are significant variations in the level of urbanization (as measured by the percentage of urban population) between the different states in India. Maharashtra and Tamil Nadu have more than 30 per cent of their population living in towns; they are the most urbanized states in India. Gujarat and West Bengal also have a very high level of urbanization with just over 25 per cent of their population in towns. The least urbanized state is Arunachal Pradesh, which has no towns with a population of 20,000 or more. This state and the union territories of Lakshadweep and Dadra and Nagar Haveli are the least urbanized areas of the country. In Himachal Pradesh only 2.6 per cent of the population lives in towns of 20,000 or more. Urbanization is at a lower level in the north-eastern region, including Assam, Nagaland, Tripura and Manipur; and in the area of the Ganga plains covering Uttar Pradesh and Bihar. Orissa has the lowest level of urbanization, 9 percent, among the bigger states in India. In general terms western and southern India is relatively highly urbanized while eastern and northern India are least urbanized.

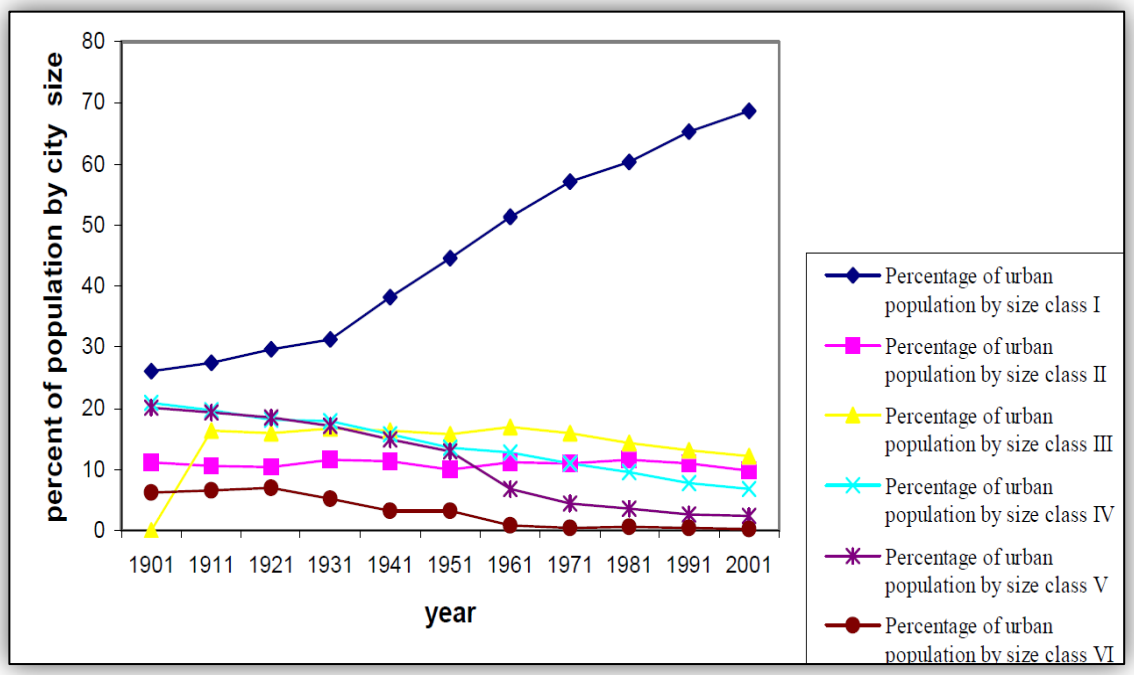
Fig.7.5: Rate of Urbanization in Indian States



The least urbanized states have the following characteristics: (a) they are hilly or mountainous, (b) they have a larger proportion of tribal population, and (c) they are generally in accessible with respect to metropolitan cities and the main arterial railways connecting them. But the plains of Orissa and Bihar, where the three characteristics noted above are absent, stand out as unexplained pockets of low levels of urbanization.

II. Structural Patterns:A important aspect of urbanization all over the world is the uneven pattern of development of small towns and big cities within the system. Every urban system is characterized by the presence of a few large cities and a large number of small towns. The large cities account for a larger share of the total urban population, while the small towns, despite their numbers, account for a smaller share. This is true of the Indian urban system, and is brought out in table.

Fig. 7.6 Category wise percentage of Urban Population in City



The million cities form the apex of the Indian urban system and account for over a quarter of India's urban population. They are followed closely by the one-lakh cities and the medium towns, each of which accounts for over a quarter of the urban population. Together these three categories add up to more than 85 per cent of the urban population. The small towns, which account for 55 per cent of the total number of towns, constitute only 13 per cent of the urban population. The mini towns have a trivial role in India's urban system. The distribution patterns of the major categories of cities and towns in the different states of India show remarkable unevenness.

III. The Metropolis and the City: Figure below illustrates that, according to 2001 census, the net addition was 546 new towns i.e., an increase of 11.83 percent during 1991-2001. The highest increase is evident in class III towns, where the number of towns increased from 517 to 1387 during 1961-2001. The number of cities (or class I towns) has risen from 105 in 1961 to 441 in 2001. The number of towns in class I to class V has been steadily rising since 1961. The total number of metropolitan cities (population one million and above) in India has increased from 23 in 1991 to 35 in 2001 and on to 53 by 2011. In addition, the number of towns has increased from

2657 in 1961 to 7935 in 2011. The results indicate an increasing trend in the addition of new cities/ towns in India.

Of the 28 states in India, 17 have no million cities. None of the union territories, excepting Delhi, possesses a million cities. While the smaller states and the union territories cannot be expected to have million cities, there are large states, in particular Bihar and Madhya Pradesh, which have no million cities. Both states ought to have these, considering the size of their population. However, they fall within the urban shadow of two leading metropolitan cities of India, namely Calcutta and Delhi. The four principal metropolitan cities account for the absence of million cities in a number of peripheral states and union territories. Thus, the state of Kerala comes under the shadow of Madras; Jammu and Kashmir, Punjab, Himachal Pradesh and Haryana come under the influence of Delhi, while Bihar, Orissa and the entire northeastern area come under the shadow of Calcutta.

Fig.7.7: Spatial Pattern and Distribution of Indian Cities

Source: Indianmaps.online

A number of states, however, have fully developed and independent urban systems with their own million cities at the apex. There were 8 such large states in India in 1981. Maharashtra had three cities with populations of a million or more, while Uttar Pradesh had two such cities in close proximity to each other. However, a major part of Uttar Pradesh comes directly under the influence of Delhi, the national capital. The other states where the urban system is dominated by one metropolitan city are the three southern states of Tamil Nadu, Karnataka and Andhra Pradesh, and the states of Gujarat, West Bengal and Rajasthan.

Table 7.3: Million Cities and Urban Agglomeration.

Census Year	Number	Population (in millions)	Percentage of Total Urban Population	Decennial Growth Rate
1901	1	1.51	5.84	-
1911	2	2.76	10.65	83.02
1921	2	3.13	11.14	13.24
1931	2	3.41	10.18	8.86
1941	2	5.31	12.02	55.76
1951	5	11.75	18.81	121.32
1961	7	18.10	22.91	54.10
1971	9	27.83	22.51	53.75
1981	12	42.12	26.41	51.35
1991	23	70.66	32.54	67.76
2001	35	107.88	37.80	52.67
2011	53	160.70	42.61	48.96

Source: Census of India (all the years)

At a lower level, the one-lakh cities play an important role in the Indian urban system. There were over 200 such cities in India in 1981. In spite of this, the entire states of Goa, Himachal Pradesh, Mizoram, Nagaland and Sikkim, and all Union Territories, excepting Delhi, Chandigarh and Pondicherry, had not even a single one-lakh city. In fact, all these territorial units are small in terms of their total population ‘which is less than 5 million in each case.

Several other states had urban systems with one city at the apex; they include Meghalaya, Manipur and Assam 1971). Each of the larger states, with a population of 10 million or more, had several one-lakh cities. Among these states, Haryana, Kerala, Bihar, West Bengal, Andhra Pradesh, Maharashtra and Tamil Nadu had a relatively higher proportion of one-lakh cities. One-lakh cities were deficient in Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh and Gujarat. These point to minor structural deficiencies in the urban systems of these states.

I. Medium Towns: The medium towns form an important link function within an urban system. They can serve to offset the deficiencies in the number of larger cities as well as of small towns. Medium towns account for over a quarter of the total number of towns as well as the total urban population. In terms of numbers, the medium towns are very strongly represented in the states of Kerala, Maharashtra and Andhra Pradesh, where they account for Over 50 per cent of the total number of towns. In West Bengal, Tamil Nadu and Bihar, they account for slightly over 40 per cent. The medium towns are poorly developed in Uttar Pradesh, Assar, Madhya Pradesh among the larger states, and Himachal Pradesh, Manipur, Meghalaya, Sikkim and Tripura among the smaller states. Medium towns form the largest urban centers in the states of Himachal Pradesh, Sikkim and Nagaland where they are called upon to act as the state capitals: Shimla Gangtok and Kohima. These towns often do not have the infrastructure required to perform such a function. In the case of Shimla, this is offset by the fact that it was the summer capital of British India, but Gangtok and Kohima are less well off. In all three cases, however, the constraints of hilly location and cold winters inhibit further expansion. Elsewhere, medium towns are major market centers for agricultural produce and have a rural oriented tertiary sector. Few of these towns have any appreciable industrial base.

II. Small Towns and Mini Towns: The smaller states and union territories as well as the less urbanized among the larger states, have a larger proportion of small towns. In these cases, the small towns constitute more than 60 per cent of the total number of towns. Among the big states, Madhya Pradesh, Uttar Pradesh, Orissa, Rajasthan and Assam are notable for the high proportion of small towns. Kerala has a lower proportion of small towns.The mini towns, though not large in number, are an important component of the urban systems of Sikkim, Meghalaya, Manipur, Himachal Pradesh, Jammu and Kashmir, and Tripura. Among the largest states, Uttar Pradesh has as many as 82 mini towns: more than a third of the 230 mini towns in the country. Mini

towns are a characteristic feature of the hill areas, particularly in Himachal Pradesh, Manipur and Jammu and Kashmir. In these areas, the nature of the terrain accounts for the small size of both rural and urban settlements. Most of the mini towns of Uttar Pradesh also belong to the hill tracts of Kumaon and Gharwal districts. Those in the plains are actually project towns, collieries, or small industrial townships. By and large, most mini towns have clear and specific urban attributes.

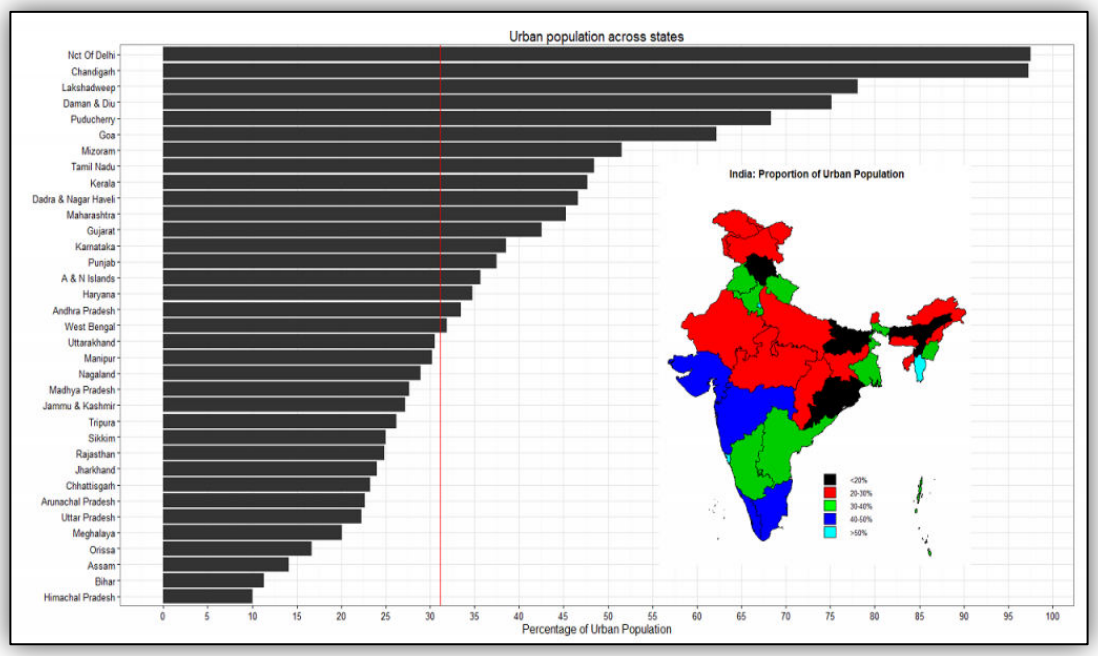
The identification of small towns, on the other hand, poses a problem. Small towns have a population of 5,000 or more; however, the number of revenue villages with a population of 5,000 or more is roughly 10,800, and of these only 1,790 are recognized by the Census as small towns. The inter-state differences in the number and ratio of small towns are least in part, due to the Census definition of urban areas.

7.3.5 REGIONAL PATTERN OF URBANIZATION

India's 3.77.11 million people forming 31.16 percent of its total population live in 4041 urban places but the distribution of towns and urban population even level of urbanization is not even in the states and union territories of the country. Table below illustrates that some states have higher level of urbanization while some other have very low and are in its initial stage. On the basis of level of urbanization all the states and union territories are classified into following three groups:

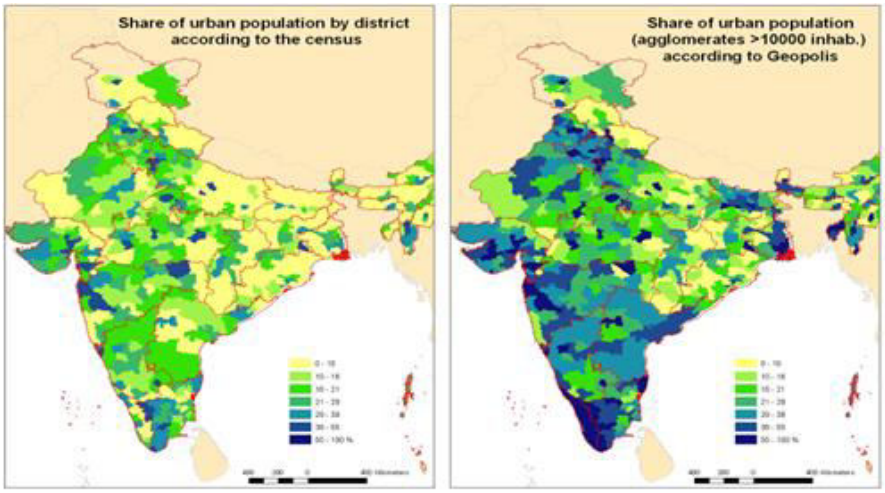
1. Highly Urbanized Region (50 percent and above): Three small political units-Delhi (97.50 percent), Chandigarh (97.25 percent), and Puducherry (68.31 percent) are highly urbanized where more than 65 percent population resides in urban centers. Due to small area and high concentration of urban population, the urban density in Delhi and Chandigarh is above 7000 persons per square kilometers. Puducherry also have urban density above 1400 persons per square kilometers. Delhi is the national capital while Chandigarh is the capital of Punjab, Haryana and Chandigarh, Lakshadweep, Daman and Diu, Goa and Mizoram are also small regions and highly urbanized.

Fig.7.8: Urban Population in Indian States



2. Medium Urbanized Region (25-50 percent): This category of urbanization includes states and union territories of the country where level of urbanization ranges 25 to 50 percent. The states and union territories of this group are Tamil Nadu, Kerala, Maharashtra, Gujarat, Karnataka, Punjab, Andaman and Nicobar island, Haryana, West Bengal, Andhra Pradesh, Manipur, Madhya Pradesh, Uttarakhand, Nagaland, Jammu and Kashmir and Tripura.

Fig.7.9: Share of Urban Population by District



3. Less Urbanized Region (Less than 25 percent): 11 states and union territories are included in this category. In this category Sikkim stands on highest position followed by Rajasthan and Jharkhand. In Uttar Pradesh, Arunachal Pradesh, Chhattisgarh and Meghalaya about 20.0 percent population lives in urban centers. Other states such as Orissa, Assam, Bihar and Himachal Pradesh have very low percentage of urban population (below 20 percent). Himachal Pradesh (10.4 percent) is the least urbanized state followed by Bihar (11.10 percent) and Assam (14.08 percent).

Table 7.4: Level of Urbanization in India (2001 and 2011)

States/ Union Territories	Percentage of Urban to		Difference between 2011 and 2011
	2001	2011	
Delhi	93.18	97.50	4.32
Chandigarh	89.77	97.25	7.48
Lakshadweep	44.46	78.02	33.56
Daman and Diu	36.25	75.16	38.91
Puducherry	66.57	68.71	1.72
Goa	49.76	62.17	12.41
Mizoram	49.63	51.51	1.88
Tamil Nadu	44.04	48.45	4.41
Kerala	25.96	47.72	21.76
Dadra and Nagar	22.89	46.62	23.73
Maharashtra	42.42	45.23	2.81
Gujarat	37.36	42.58	5.22
Karnataka	33.98	38.57	4.59
Punjab	33.92	37.49	3.57
Andaman and Nicobar	32.63	35.67	3.04
Haryana	28.92	34.79	5.87
Andhra Pradesh	27.30	33.49	6.19
West Bengal	27.97	31.89	3.92
Manipur	25.58	30.21	3.68
Nagaland	17.23	28.97	11.74
Madhya Pradesh	26.46	27.63	1.17
Tripura	17.06	26.18	9.12
Sikkim	11.71	24.97	13.80

Source: Census of India, 2011

7.3.6 MAIN CHARACTERSTICS OF INDIAN URBANIZATION

1. India has a long history of urbanization which began as early as in 3000 B.C. when a number of urban centers flourished in Indus valley.

2. The process of urbanization in India was very slow till beginning of the 20th century. The growth rate of urban population during first and second decades was amazingly low to the effect of famine and influenza epidemic. The urban population showed an explosive growth after 1931. The period of rapid urbanization started since 6th decade of twentieth century.

3. The urbanization was in the past largely proceeded by means of rural-urban migration and this feature is still highly significant in the process of urbanization in India. The rural push created by rural population pressure, poverty and unemployment is a major factor in the growth of cities in India.

4. Studying urbanization in India, Peach observed: Industrialization and urbanization, so stably married in the industrialization are often divorced in India. The match-makers of policy aimed at industrialization. Here the rate of industrialization, however, has failed to keep pace with urbanization which has created a number of socio-economic problems there.

5. The process of urbanization in India is of subsistence nature. Here uneducated even illiterate and unskilled people from rural areas swarm into large towns and cities to seek employment. Most of them remain either unemployed or are low paid. Consequently they may be eating worse food and live in worse house of slums. This urban ward migration affects badly the quality of city life in India.

6. In India, urban centers particularly large town and cities are growing more on the basis of tertiary sector rather than on the basis of secondary sectors.

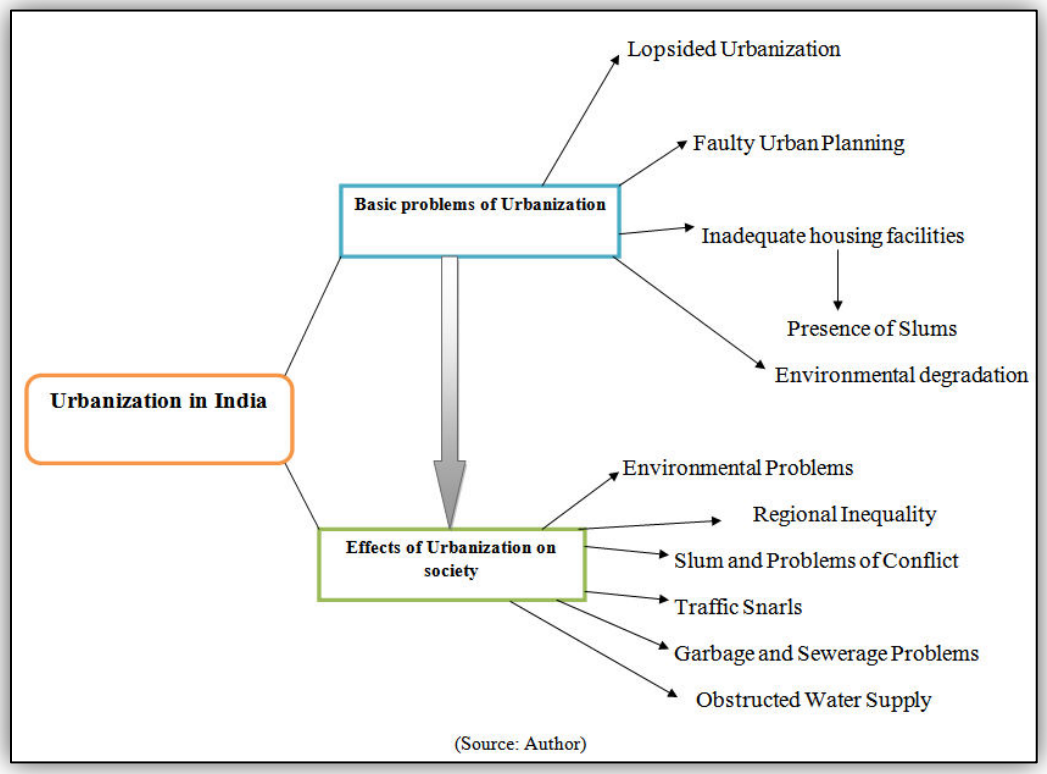
7. The level of urbanization is higher in southern India than in northern India, and western part is more urbanized then eastern part of the country.

7.3.7 THE PROBLEMS OF URBANIZATION

The use of modern technology is increased in cities in the industrial fields. So the figure of employees is increasing more rather than the figure of employment. Hence, urban unemployment increases. It is due to urbanization, the problem of habitat emerges. So people live in filthy Chaws, roads which give birth to theft, loot, prostitution etc…The pollution of air, water and noise increases in cities due to industrial development and increasing vehicles.

1. Rural urban migration: A large part of migration and urbanization in India have been linked to stagnation and volatility of agriculture and lack of sectoral diversification within agrarian economy. The growth rates in agricultural production and income has been noted to be low, unstable and disparate across regions over the past several decades, resulting in lack of livelihood opportunities in rural areas. A low rate of infrastructural investment in public sector in the period of structural adjustment - necessary for keeping budgetary deficits low - also have affected agriculture adversely. This has led to out-migration from several backward rural areas, most of the migrants being absorbed within urban informal economy. But the capacity of the cities and towns to assimilate the migrants by providing employment, access to land, basic amenities etc. are limited. The problem have acquired severity as migrants have shown high selectivity in choosing their destinations (understandably linked with availability of employment and other opportunities), leading to regionally unbalanced urbanization as also distortions in urban hierarchy. Rural urban migration has often been considered the major factor for growth of slums in urban areas.

Fig. 7.10: Urbanization in India- Problems and Effects



2. Emergence of slums: The most important problem in all cities has been housing the sudden and large scale influx of migrants from rural areas to urban areas especially the metropolises and state capitals. Due to lack of housing, in every city almost fifty percent population lives in slums. Slums known as bustees (Basties) in India, favelas in Brazil, katchiabadis in Pakistan and focus insalubres in Cuba, all have few characteristics in common: • Poor structural quality and durability of housing • Insufficient living areas (more than three people sharing a room) • Lack of secure tenure • Poor access to water.

3. Urban transport: India is transiting from a developing to developed country with high pace of economic development. Urbanization is too increasing at high pace as mega cities, cities and towns are providing better economic opportunities. Fast growing cities have nurtured business and industry, and have provided jobs and higher incomes to many migrants from rural areas. Thus, it is important that cities function efficiently, that their resources are used to maximize the cities' contribution to national income. City efficiency largely depends upon the effectiveness of its transport systems, i.e., efficacy with which people and goods are moved throughout the city. Poor transport systems hampers economic growth and development, and the net effect may be a loss of competitiveness in both domestic as well as international markets.

4. Waste disposable: Removing garbage, cleaning drains and unclogging sewers are the main jobs of municipalities and municipal corporations in Indian cities. In most cities, the municipal service for the collection and transportation of urban solid wastes comprises three separate functions as follows: • sweeping, curbside and domestic waste collection from garbage bins. • Transportation by handcarts to large or road collection points, which may be open dumps. • Transportation by vehicles to the disposal sites. The weaknesses of the existing system of solid waste management are: (i) the professional and managerial capacities of the municipal bodies are limited and this is more pronounced in case of smaller cities; (ii) no charges are levied for garbage collection or disposal, nor are there any incentives for reducing garbage or recycling waste; (iii) no separate costing is done for this function; (iv) indiscriminate use of plastic bags and goods; (v) recourse to modern technology is rare and; (vi) segregation of garbage at the source is not enforced.

5. Water drainage and sanitation: According to the 2011 Census, amenities available with the households has been listed as follows: 87% of households are using tap, tube well, hand pump and covered well as the main source of drinking water while 43.5 percent use tap water. Only 47% of households have source of water within the premises while 36% of households have to fetch water from a source located within 500 mts in rural areas/100 mts in urban areas and 17% still fetch drinking water from a source located more than 500 mts away in rural areas or 100 mts in urban area. No city has round the clock water supply in India. Intermittent supply results in a vacuum being created in empty water lines which often suck in pollutants through leaking joints. Many small towns have no main water supply at all and are dependent on the wells. To overcome these problem Municipal bodies must focus on increasing operational efficiencies through reduction in pilferage, improving efficiency of staff and use of technology. Further the municipal bodies should meter all water connection within a time frame. Installing a hierarchy of metering system could help in identifying pilferage.

Drainage situation is equally bad. Around half of the households have drainage connectivity with two-third have the open drainage and one-third has the closed drainage. Because of the non-existence of a drainage system, large pools of stagnant water can be seen in city even in summer months. Further the sanitation problem is also high due to lack of toilet facilities in slums areas. According to the census, 47% of the households have latrine facility within premises with 36% households have water closet and 9% households have pit latrine. Thus, practice of open defecation is prevalent. Human waste is also responsible for spreading of water born diseases like typhoid, cholera, shigellosis, amebic dysenteries, diarrhea, etc. The practice of open defecation in India comes from a combination of factors the most prominent of them being the traditional behavioral pattern and lack of awareness of the people about the associated health hazards.

6. Electronic waste: A new type of hazardous waste has come up in recent years, namely electronic waste. E-waste consists of all waste from electronic and electrical appliances which have reached their end- of- life period or are no longer fit for their original intended use and are destined for recovery, recycling or disposal. It includes computer and its accessories monitors, printers, keyboards, central processing units; typewriters, mobile phones and chargers, remotes, compact discs, headphones, batteries, LCD/Plasma TVs, air conditioners, refrigerators and other

household appliances. The composition of e-waste is diverse and falls under 'hazardous' and 'non-hazardous' categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete, ceramics, rubber and other items. Iron and steel constitute about 50% of the waste, followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminum and precious metals like silver, gold, platinum, palladium and so on. The presence of elements like lead, mercury, arsenic, cadmium, selenium, hexavalent chromium, and flame retardants beyond threshold quantities make e-waste hazardous in nature. It contains over 1000 different substances, many of which are toxic, and creates serious pollution upon disposal. Obsolete computers pose the most significant environmental and health hazard among the e-wastes. There are 10 States that contribute to 70 per cent of the total e-waste generated in the country, while 65 cities generate more than 60 per cent of the total e-waste in India. Among the 10 largest e-waste generating States, Maharashtra ranks first followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. Among the top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bengaluru, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur. The main sources of electronic waste in India are the government, public and private (industrial) sectors, which account for almost 70 per cent of total waste generation. The contribution of individual households is relatively small at about 15 per cent; the rest being contributed by manufacturers. Though individual households are not large contributors to waste generated by computers, they consume large quantities of consumer durables and are, therefore, potential creators of waste.

7. Urban poverty: Urban poverty is a major challenge before the urban managers and administrators of the present time. Though the anti-poverty strategy comprising of a wide range of poverty alleviation and employment generating programmes has been implemented but results show that the situation is grim. Importantly, poverty in urban India gets exacerbated by substantial rate of population growth, high rate of migration from the rural areas and mushrooming of slum pockets. Migration alone accounts for about 40 per cent of the growth in urban population, converting the rural poverty into urban one. Moreover, poverty has become synonymous with slums. The relationship is bilateral i.e. slums also breed poverty. This vicious circle never ends. Most of the world's poor reside in India and majority of the poor live in rural

areas and about one-fourth urban population in India lives below poverty line. If we count those who are deprived of safe drinking water, adequate clothing, or shelter, the number is considerably higher. Further, the vulnerable groups such as Scheduled Castes, Scheduled Tribes, minorities, pavement dwellers etc., are living in acute poverty. Housing conditions in large cities and towns are depicting sub human lives of slum dwellers. With the reconstruction of poverty alleviation programmes in urban India it is expected that social and economic benefits will percolate to the population below the poverty line. However, eradication of poverty and improving the quality of life of the poor remains one of the daunting tasks.

8. Haphazard growth of cities: The most important obstacle to sustainable growth of cities is the total lack of regulation of this sector, nowadays; it is laced with black money, corruption, red tapism and land mafias and corruption. It is also recognized that existing laws on land registry, transfer of property, contracts and related matters are themselves inadequate in this context and are implemented by different authorities and they cast no responsibility (or liability) on the builder/developer for observing certain core norms in the contracts with home-buyers. In recent years, considerable progress has been made in setting up empowered regulatory bodies for the financial sector for investments in corporate, companies and mutual funds

7.3.8 THE SOLUTION OF URBANIZATION

To solve the problem of urbanization, we should apply the following solutions: (a) To create Employment at Rural Level: The chief responsible factor for urbanization is limited employment in villages. We should try to create more and more employment in rural areas itself. We should develop agricultural industries, rural industries, forests and rural skills in rural areas so as to provide employment as well as deteriorate the migration towards the cities. (b) The Development at Agricultural Level: The main source of income and employment of villagers is based on farming. But unfortunately, even after 59 years of Economic Planning, we are unable to provide the irrigation facility to the useful land for farming. Where the farming is based only on Monsoon, in such areas, it has become difficult to live in such draughty condition. More development should be made in agriculture in rural areas and if its benefits one reached to the villagers, there will definitely be deterioration in urbanization. (c) The Development of Businesses based on Agriculture: With the development in agriculture in villages, we should start

some business based activities on agriculture like animal husbandry, poultry, sowing trees as to provide employment to the villagers in addition to agriculture. It will increase their income and that will change their attitude of migrating towards cities. (d) Use of Natural Resources of Villages: If we can use the natural resources of villages like land, water, jungles, human wealth, animals etc…in sufficient way, the chances for employment can be increased and that will decrease urbanization. (e) To Create Modern Services in Villages: The dearth of facilities like cities in villages is one of the responsible reasons of migration. A young man of village, who comes to city for education, is not ready to go back to his village due to the lack of facilities. Those who have settled in cities are also not ready to make the marriage of their daughters in villages for the same reason. The facilities like water, habitat, roads, primary education, primary health centers, 24 hours electricity etc… should be made available in villages. If the facilities like multiplex theatres, modern hotels and entertainment are provided in villages, it will boost employment and there won't be any difference between cities and villages and that will solve the problem of urbanization.

7.4 SUMMARY

This is rightly said, that this century is urban century, where more people are living in urban areas. The urbanization concept provides both the challenges and opportunities for every country, although it may not be uniform in every country. In India also, the urban population is increasing in good number, but there exist a problem of infrastructure deficit, which was a big hurdle in the way of providing basic services to the people and also more importantly the economic growth of the country. Thus, it is the right time for our country, to think and act seriously about the negative implications of the urbanization concept, and make it useful for the development of the country. But, urbanization needs to be sustainable in two counts i.e. First, it is needed to equally benefit of all the people in the society i.e. socially inclusive and secondly, environmentally sustainable. Also, generally the three important questions needs to be answered by the future study on urbanization are, first question is regarding, 'what does urbanization mean for rural areas needs to be explored'? The second question is 'does urbanization leads to reduction in poverty rate is questionable'? Thirdly, 'are the developing and under-developing countries are prepared to handle their urban transition'? The answer to these questions will help

us to understand, the urbanization concept very well for the development of any society and people living in it, including India.

7.5 GLOSSARY

1. Urban: It relates to, or constituting a city or town. Living in a city or town. (Of music) emerging and developing in densely populated areas of large cities, esp. those populated by people of African or Caribbean origin Compare rural.

2. Urbanism: It explain the chief form of the condition of life. It represents a revolutionary change in the whole pattern of social life. Urbanism is considered as a condition or set to circumstances.

3. Urbanization: Urbanization is a shift of people from village to city. If the rate of increase in urban population is just equal or less to the rate of increase in rural population, it might be said that there is no increase in urbanization. In the real sense, if the thinking, ideas and social values are urban, in that situation these people are urbanized in spite living in a village.

4. Metropolis:A metropolis is a large city or conurbation which is a significant economic, political, and cultural ... This article is about the political definition of "metropolis".

5. Town:A town is a medium-sized human settlement. Towns are generally larger than villages but smaller than cities, though the criteria which constitute them vary considerably in different parts of the world.

6. Cities:A city is a large human settlement. Cities generally have extensive systems for housing, transportation, sanitation, utilities, land use, and communication.

7.6 ANSWER TO CHECK YOUR PROGRESS

1. Urbanization refers to the increasing growth and development of cities and towns.
2. To check the progress of urbanization, one can examine population data to see how many people are living in urban areas compared to rural ones.
3. A notable trend in urbanization is the migration of people from rural areas to urban centers in search of better economic opportunities and improved living standards.

4. The expansion of infrastructure, such as roads, buildings, and public services, is a key indicator of urbanization progress.
5. Additionally, monitoring the rate of urbanization, which is the percentage of a country's population living in urban areas, helps track the ongoing trend.

7.7REFERENCES

1. Census of India: 1961,1971,1981,1991,2001,2011

2. Singh, R.L. (1973); Urban Geography in Developing Countries. NGSI: Varanasi

3. Mishra, R.P. and K. Mishra (1988); Million Cities in India. New Delhi

4. Despande, S.andDespande, L. (1998) " Impact of Liberalisation of Labour Market in India :What Do Facts from NSSO's 50th Round Show" Economic and Political Weekly, Vol.33No 22,ppL21-L31

5. Kundu, A (1983): "Theories of City Size Distribution and Indian Urban Structure – AReappraisal", Economic and Political weekly, 18(3).

6. Premi, M. K. (1991): "India's Urban Scene and Its Future Implications", Demography India,20(1)

7. Registrar General (1991) Census of India , Emerging Trends of Urbanisation in India,Occasional paper No. 1 of 1993, Registrar General, New Delhi

8. Registrar General, 2001: Census of India, 2001, India, 2A, Mansingh Road, New Delhi110011, 25th July, 2001

9. Sen, A. and Ghosh, J. (1993): Trends in Rural Employment and Poverty Employment Linkage,ILO-ARTEP Working Paper, New Delhi

10. Sovani, N. V. (1966): Urbanisation and Urban India, Asia Publishing House, Bombay

7.8 TERMINAL QUESTIONS

(A) Long Questions

1. Examine the trends of urbanization in India from the mid of 19th century to till to date.
2. India has observed the rapid growth rate of urbanization during the last three decades. Clarify.
3. Examine the contribution of large cities in the urbanization of India.
4. India has a slow pace of urbanization. Clarify this statement.
5. Write an essay on urban region of India.
6. Discuss the problems associated with Indian urbanization.
7. Discuss the main areas of urban concentration in India.

(B) Short Questions

1. What is urbanization?
2. What are the main drivers of urbanization?
3. What percentage of India's population is currently living in urban areas?
4. How has the rate of urbanization in India changed over the past few decades?
5. What are the challenges associated with rapid urbanization in India?
6. Can you name some of the major metropolitan cities in India that have experienced significant urban growth?
7. How does urbanization affect the demand for basic services like housing, healthcare, and education in India?
8. What government initiatives or policies are in place to manage urbanization and its impact on India?
9. How does urbanization impact employment patterns and opportunities in India?
10. What are some of the potential benefits of urbanization for India's economy and society?

(C) Multiple choice questions

1. What is urbanization?
A. The growth of rural areas
B. The increase in urban population
C. The expansion of forests
D. The development of highways
Answer: B
2. Which of the following is a primary driver of urbanization in India?
A. Decreasing job opportunities in cities
B. Growth of agriculture in rural areas
C. Industrialization and economic development
D. Strict government policies limiting urban growth
Answer: C
3. What is the approximate urban population percentage in India as of 2021?
A. 30%
B. 50%
C. 70%
D. 90%
Answer: B
4. Which of the following regions in India has the highest level of urbanization?
A.Northern India
B. Southern India

C. Western India
D. Eastern India
Answer: C
5. What is the trend of rural-to-urban migration in India?
A. It has significantly decreased in recent years.
B. It has remained relatively constant.
C. It has steadily increased over time.
D. It is negligible and not relevant.
Answer: C
6. Which city is often referred to as the "Financial Capital of India" and is a significant urban center?
A. New Delhi
B. Kolkata
C. Mumbai
D. Chennai
Answer: C
7. Which of the following is a common issue associated with rapid urbanization in India?
A. Increased agricultural production
B. Decreased air pollution
C. Slums and inadequate housing
D. Abundant natural resources
Answer: C
8. What is the Smart Cities Mission in India aimed at achieving?
A. Developing cities with advanced technology only
B. Promoting sustainable urban development and improving quality of life
C. Building more shopping malls in urban areas
D. Reducing urban population through migration policies
Answer: B
9. Which government agency is responsible for urban planning and development in India?
A. Indian Space Research Organization (ISRO)
B. Ministry of Urban Development
C. Department of Agriculture
D. Indian Railway Corporation
Answer: B
10. What is the impact of urbanization on the environment?
A. Reduced strain on natural resources
B. Increased green spaces and forests in cities
C. Elevated pollution levels and pressure on resources
D. Preservation of wildlife habitats
Answer: C

UNIT- 8 TRIBAL AREAS AND THEIR PROBLEMS

8.1 OBJECTIVES

After having the detailedstudy of this unit, you will be able to:

- Define and classify tribes of India.
- Explain spatial distribution of Indian tribes at state and districts level.
- Assess various problems faced by tribal community.

8.2 INTRODUCTION

The tribal are the economically backward ethnic group in India. They are food gathers, hunters, forestland cultivators, and minor forest product collectors. They lived in isolation with near to nature hence, called son of soil. Tribes constituted separate socio-cultural groups having distinct customs, tradition, marriage, kinship, property inheritance system and living largely in agricultural and pre-agricultural level of technology (Nagada, 2004).

Article 366 (25) of the Constitution of India refers to Scheduled Tribes as those communities, who are scheduled in accordance with Article 342 of the Constitution. This Article says that only those communities who have been declared as such by the President through an initial public notification or through a subsequent amending Act of Parliament will be considered to be Scheduled Tribes.

Fig. 8.1: Showcasing Tribes in India

India is a home of number of tribes there are over 314 communities. Tribal society as define as a collection of families bearing a common name, speaking a common dialect, occupying a commonterritory. Simple the word tribe means a group of families, living in a contiguous region, speaking a common language and having a historical past. The constitution of India provides a definition. According, articles 342 of constitution of India, the scheduled tribes are the tribes or communities, which have been declared as such by the Hon'ble president of India.

India has a large mass which shelters different varieties of human races. The incoming of these races started since early Paleolithic period through the mountain passes of the north-west which provided ancient land routes to India. New immigrants pushed early settlers south and eastwards to interior part of the country. Many foreign invaders coming from the north-west although returned to their homeland with plundered booty but some of them decided to settle here. All these helped in the formation of mixed racial characteristics in the country. So much so that India has a unique assemblage of human races rarely seen elsewhere in the world.

Although majority of the scholars believe that earlier human races migrated to India from Africa, Mediterranean, West Asia and Central Asia but a group of anthropologist consider India as the cradle land for a number of human races from where they migrated to Sri Lanka, Malaysia, Indonesia, Thailand, Australia and Africa. Palaeontology and researchers have given evidences that Siwalik area has been the home of early human ancestors. According to Haddon Pre-Dravidian were the first to occupy this territory. P. Mitra consider Proto-Negroid to be the first settlers, while D.N. Mazumdar give this credit to Proto-Australoids. According to B.S. Guha Negrito races were the first to appear on this land and were followed by Proto-Australoids, Pre-Dravidians, Mediterranean's and Nordics.

8.3 TRIBAL AREAS AND THEIR PROBLEMS

Indian tribes and their classification

Sir Herbert Risley (1901) was the first scholars to present a lucid description of the Indian races and their origin. Taking into account the linguistic, cultural and racial attributes he classified India's races into seven major categories.

Table 8.1: Classification of Indian Races by Herbert Risley.

Race	Sub-type	Distribution
Turko-Iranian	Afghan, Baluchi	Baluchistan, North West Frontier Province area of Pakistan
Indo-Aryan	Rajput, Khatri, Jat	Rajasthan, Punjab, Kashmir Valley

Scytho-Dravidian	Nagar Brahman, Maratha Kumbis, Coorgis	Gujarat, Maharashtra, South-West Sindh
Arya-Dravidian	Indo-Aryan, Dravidian	Uttar Pradesh, Bihar, East Rajasthan
Monglo-Dravidian	Bengali	West Bengal, Coastal Orissa
Mongoloid	Palaeo, Tibeto	Himalayan Region, Nepal, Assam, Sikkim
Dravidian	Palaeo Dravidians	Tamil Nadu, Andhra Pradesh, Kerala, Madhya Pradesh

This classification could not gain popularity because it does not take into account the physical/hereditary characteristics of human races. It is mainly based on such elements like language and culture which are not very much related to the racial characteristics. Risley also not metioned the Negrito race whose representative are seen in Kochi, Hills of the south India, Andaman and Nicobar, Lakshadweep and Maldives.

India contains an unparalleled variety of ethnic groups, patterns of culture and modes of living. "The People of India" a Project of the Anthropological Survey of India has identified about 461 tribal communities of India out of which 174 have been identified as sub-groups. They number about 67,758,000 according to the 1991 Census comprising about 8.01 per cent of the total population of the country. In this Unit we will look into the distributional patterns of the tribes of India. Even though there is not a single and definite system of classifying the tribes of India, attempts have been made by different anthropologists from time to time to distribute the tribes. There are mainly two categories to classify the tribes. They are: I) Permanent traits: This includes factors like geography/ territory, language, physical/racial attributes and size. II) Non-Permanent or acquired traits: This includes factors like economy or subsistence pattern and the degree of incorporation into the Hindu society.

1. Geographical: The tribes of India are dispersed widely over geographical territory and scholars have attempted to arrange them along the regions they inhabit. Based on the geographical location and the tribal demographical set-up, anthropologists have tried to chalk out a zonal classification or a regional grouping of the tribes of India. For instance, B.S. Guha has classified the tribes of India into three zones:

1. The north and north-eastern zone in the mountain valleys and eastern frontiers of India.

2. The central or middle zone occupying the older hills and plateaus along the dividing line between the Peninsular India and the Indo-Gangetic Plains including the converging line of the Western Ghats.

3. The southern zone comprising the whole of the Peninsular India.

D.N. Majumdar and T.N. Madan in their book 'Introduction to Social Anthropology' have also offered a similar classification. They are Northern and North-Eastern Zone, the Central or Middle Zone and the Southern Zone.

S.C. Dube has demarcated four geographical regions including the North and North-Eastern Zone, Middle Zone, the South Zone and the West Zone. Taking into consideration the zonal classification given by different anthropologists from time to time and keeping in mind the geographical, ecological, socio-economic, administrative, ethnic and racial factors, L.P.Vidyarthi put forward a five-fold classification system which included the following: the Himalayan region, Middle India, Western India, South India and the Islands.

1. The Himalayan region is sub-divided into: A) North-eastern Himalayan region comprising the states of Assam, Meghalaya, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and the mountaineous region of West Bengal including Darjeeling. B) Central Himalayan region comprising the Terai areas of Uttar Pradesh and Bihar and C) North-Western Himalayan region comprising the states of Himachal Pradesh and Jammu and Kashmir. The tribes inhabiting this region are the Akas, Daflas, Apatanis, Mishmis, Khamptis, Singphos, Kukis, Khasis, Garos, Lepchas, Bhotias, Tharus, etc.

2. Middle India Region comprising the states of Bihar, West Bengal, Orissa and Madhya Pradesh. About 55% of the total tribal population of the country lives in this region. The tribes inhabiting this region are the Juangs, Kharia, Khonds, Bhumijs, Baiga, Muria, Marias, Mundas, Gonds, Santhals, Oraons, etc.

3. Western India Region comprising the states of Rajasthan, Gujarat, Maharashtra, Goa and the Union Territory of Dadra and Nagar Haveli. The tribes inhabiting this region are the Barodias, Bharwads, Bhils, Damors, Dhanwars, Dhodias, Girasias, Gonds, Katkaris, Koknas, Kolis, Minas, Siddi, Warlis, etc.

4. South India Region comprising the states of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. The tribes inhabiting this region are the Chenchus, Irulas, Paniyans, Kurumbas, Kadars, Todas, Badagas, Kotas, etc.

5. The Island Region comprising the islands of Andaman and Nicobar in the Bay of Bengal and Lakshadweep in the Arabian Sea. The tribes inhabiting this region are the Jarwas, Onges, the GreatAndamanese, North Sentinelese, etc.

K.S. Singh has offered a similar classification of tribes of India into the Northeastern India, Middle India, Southern India, North-western Himalayas, and Andaman and Nicobar Islands Zones. Within this geographical classification, there is a lot of disparity in regards to the distribution of the tribal population of the country. A very high concentration of the tribal population in the eight states of the central or middle India comprising of about 85 percent of the total tribal population. This is followed by the eight north-eastern states comprising of about 11 percent while the rest is distributed over the states and union territories of the northern and southern India.

2. Linguistic: Besides classifying the tribes according to territory, they are also classified according to language or linguistic categories. Four broad language groups have been identified amongst the tribes of India which are Indo-Aryan,Austro-Asiatic, Dravidian and Tibeto-Burman. Tracing the linguistic map of India, we can see that the tribal people of India speak different languages in different regions and groups. One can find that the Dravidian language is spoken in southern India and in some pockets in central India; theAustro-Asiatic language is spoken in some pockets in the north-eastern Himalayan region of Meghalaya, in Nicobar Islands and most part of central India; the Tibeto-Burman language is spoken in the entire Himalayan region whereas the Indo-Aryan language is spoken in the remaining areas of the rest of the country. L.P Vidyarthi and Binay Kumar Rai in their book "The Tribal Culture of India" put forward a classificatory system of the languages of Indian tribes: Dravidian, Austro-Asiatic, Tibeto-Chinese, Indo-Aryan.

3. Racial: On the basis of the physical attributes, anthropologists have tried to categories the tribal population from time to time. But due to the lack of available knowledge and scanty direct evidence, the determination of the racial genesis and affinities of the tribal communities of India is a very complicated task. The first attempt to categorise the Indian tribal communities in a scientific manner based on the racial characteristics was done by Sir Herbert Risley. He classified the entire population of the country into seven racial types which are TurkoIranian, Indo-Aryan, Scytho-Dravidian, Aryo-Dravidian, Mongolo-Dravidian, Mongoloid and the Dravidian.

No separate classificatory scheme for the tribal population was given. A more recent attempt of classification was given by J.H. Hutton, S.C. Guha and D.N. Majumdar out of which the most accepted classification is that offered by S.C. Guha who listed six main races with nine sub-types. They are as follows:

I. Negrito

II. Proto- Australoid

III. Mongoloid A) Paleo-Mongoloids- Long-headed and Broad-headed B) Tibeto-Mogoloids

IV. Mediterranean A) Palaeo- Mediterranean B) Mediterranean C) Oriental type

V. Western Brachycephals A) Alpinoid B) Dinaric C) Armenoid

VI. Nordic Guha has also drawn conclusions as regards to the racial composition of the tribes of India. They are: I) Negrito: 30 Tribal Cosmogenies II) Proto-Australoid III) Mongoloid

4. Size: Anthropologists have also attempted to classify the tribal groups according to their demographic size. It is interesting to note that tribal populations of India vary immensely with regards to their respective sizes. On one hand we find tribal communities like the Gonds, Bhils, (both designated with their generic names) with a population of about forty lakhs each followed by the Santhals with a population of more than thirty lakhs. They are followed by the Oraons, Minas and the Mundas who number about more than ten lakhs each. They are followed by the Hos, Khonds and the Kols with population strength of more than five lakhs. Yet another more than forty tribes, comprising about ten percent of the total tribal population of India have a population ranging from one to five lakhs. These are the Adis, Baigas, Bhumijs, Bodos-Kacharis, Dhodias, Garos, Kacharis, Kharias, Kharwars, Khasis, Kolhas, Korkus, Lodhas, Mizos, Rabhas, Saoras, Tripuris, Warlis, Yenadis and Yerukulas,to name a few. On the contrary there are communities like some Andamanese groups who number even less than hundred each. There is a lot of variation in size even within the tribal groups who lie in between these two categories- somewhere from between less than 1000 to less than a million.

5. Economy or Subsistence Pattern: On the basis of the mode of livelihood or the subsistence pattern, Indian tribes can be divided into:

1. Food gatherers and hunters

2. Horticulturists

3. Pastoralists

4. Hill cultivation type

5. Agriculturists

6. Simple Artisan

7. Folk Artist

8. Laborers and

9. Industrial workers

8.3.1 DISTRIBUTION OF TRIBES IN INDIA

India is having second largest concentration of tribal population in the world. There are over 314 tribal communities in India, known by different names such as the Adivasis- the

original inhabitants, Vanya Jati (live in forest), Adim Jati- primitive people, etc. Tribals are most backward community in India. The Indian tribes display a very high degree of ethnic diversity both in their racial composition and dialectal and linguistic affinity. There are 285 different tribal communities, which show an important index of their ethnic diversity. No less impressive is the pattern of their spatial distribution, it has been commonly observed that the tribes reveal strong tendencies of clustering and concentration in the hilly, forested and the geographically inaccessible tracts of the country (Ahmad, 1999). This is the main cause for their backwardness.

Tribal population is concentrated in geographically inaccessible areas so one can say development of tribals mostly depends on the distribution of population in relation to resource available in the region. Population and the natural resources are the most important aspects of regional development. In this context growth and distribution of tribal population is an important aspect (Ramotra and Mote, 2009).

In Spatial and cultural consideration Indian scheduled tribe population is at widely different stage of social, cultural, political as well as economic development. The scheduled tribes account for a sizeable proportion of the population of India. They constitute an important segment of the Indian social fabric. These communities belong to different ethno-lingual groups and profess diverse faiths. Living at disparate levels of socio-economic development, they are spread along the entire spectrum of social evolution in India ranging from the industrial workers (Raza and Ahmad, 1990). As per the 1991 census the scheduled tribe population in India was 6.78 crores, which constituted about 8.01 per cent of the total population. According to 2001 census the scheduled tribes constituted about 8 per cent in India.

The largest concentration of scheduled tribe is confined to central India particularly in Madhya Pradesh and in its adjoining states like Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Zarkhand, Orissa and Bihar. In Maharashtra the scheduled tribe population was 73.18 lakhs (1991), which constituted 9.27 per cent of the total population of the state. It has now increased to 85.77 lakhs in 2001 but the proportion has reduced to 8.85 per cent. In Maharashtra concentration of tribal population is mostly confined to north-eastern and north western parts. In the north-western part of the state particularly Thane, Nashik, Dhule and Nandurbar districts where more than 43.

The tribal population of the country, as per 2011 census, is 10.43 crore, constituting 8.6% of the total population. 89.97% of them live in rural areas and 10.03% in urban areas. The decadal population growth of the tribe's from Census 2001 to 2011 has been 23.66% against the 17.69% of the entire population. 9 (2001) per cent concentration of tribal population in the state is concentrated.

The trend in ST population since Census 1961 is illustrated in Table 8.2. From 30.1 million in 1961, the ST population has increased to 104.3 million in 2011.

Table 8.2: Trends in Proportion of Scheduled Tribe Population.

Year	Total Population	Scheduled Tribes	Proportion of STs
1961	439.2	30.1	6.9
1971	547.9	38.0	6.9
1981	665.3	51.6	7.8
1991	838.6	67.8	8.1
2001	1028.6	84.3	8.2
2011	1210.8	104.3	8.6

Source: Census of India

Broadly the STs inhabit two distinct geographical areas – the Central India and the North- Eastern Area. More than half of the Scheduled Tribe population is concentrated in Central India, i.e., Madhya Pradesh (14.69%), Chhattisgarh (7.5%), Jharkhand (8.29%), Andhra Pradesh (5.7%), Maharashtra (10.08%), Orissa (9.2%), Gujarat (8.55%) and Rajasthan (8.86%). The other distinct area is the North East (Assam, Nagaland, Mizoram, Manipur, Meghalaya, Tripura, Sikkim and Arunachal Pradesh).

Table 8.3: Changes in Tribal Population in 2001and 2011

State/UT	% to total population		Additions in the list after Census 2001
	2001	2011	
Himachal Pradesh	4.0	5.7	9 Beta, Beda 10 Domba, Gara, Zoba Area restriction removed for Gaddi and Gujjar
Sikkim	20.6	33.8	3 Limboo 4 Tamang
Arunachal Pradesh	64.2	68.8	All tribes of the State are included in the list. After Census 2001, more specific names like Idu, Taroan, Hrusso, Tagin, Khanba and Adi have been mentioned in this list
Goa	0.0	10.2	6 Kubnbi 7 Gawad 8 Velip
Jammu & Kashmir	10.9	11.9	No change
Rajasthan	12.6	13.5	No change
Uttar Pradesh	0.1	0.6	Change from SC to ST for different names in specified districts
Manipur	34.2	35.1	30 Poumai naga 31 Tarao 32 Khram 33 Any Kuki tribes
Tripura	31.1	31.8	Sub-tribe names under: 6 Bengshel, Dub, Kipend, Kalai, Karbong, Legui, Mussum, Rupini, Sukuchep, Thangchep 14 Murasing
Odisha	22.1	22.8	Addition of names in many Listed tribes
Madhya Pradesh	20.3	21.1	Change in area restriction for some of the tribes

Source : Presentation "SCHEDULED TRIBES IN INDIA, Census 2011" by Registrar General of India, May 2013

Table 8.4 State/UT with Percentage of Trible Population More than the Country Average

S. No	India/State	% age of STs in the State to total State population in 2011	% age of STs in the State to total ST population in India in 2011
1	Lakshadweep	94.80	0.06
2	Mizoram	94.43	0.99
3	Nagaland	86.48	1.64
4	Meghalaya	86.15	2.45
5	Arunachal Pradesh	68.79	0.91
6	Dadra & Nagar Haveli	51.95	0.17
7	Manipur	35.12	0.87
8	Sikkim	33.80	0.20
9	Tripura	31.76	1.12
10	Chhattisgarh*	30.62	7.50
11	Jharkhand*	26.21	8.29
12	Orissa	22.85	9.20
13	Madhya Pradesh	21.09	14.69
14	Gujarat	14.75	8.55
15	Rajasthan	13.48	8.86
16	Assam	12.45	3.72
17	J&K	11.91	1.43
18	Goa	10.23	0.14
19	Maharashtra	9.35	10.08

* States like Chhattisgarh, Jharkhand and Uttarakhand were created in the year 2000 after re-organization of the states of Madhya Pradesh, Bihar and Uttar Pradesh. MANIPUR (Excl. 3 Sub-divisions of Senapati Distt.)

Source : Census 2011

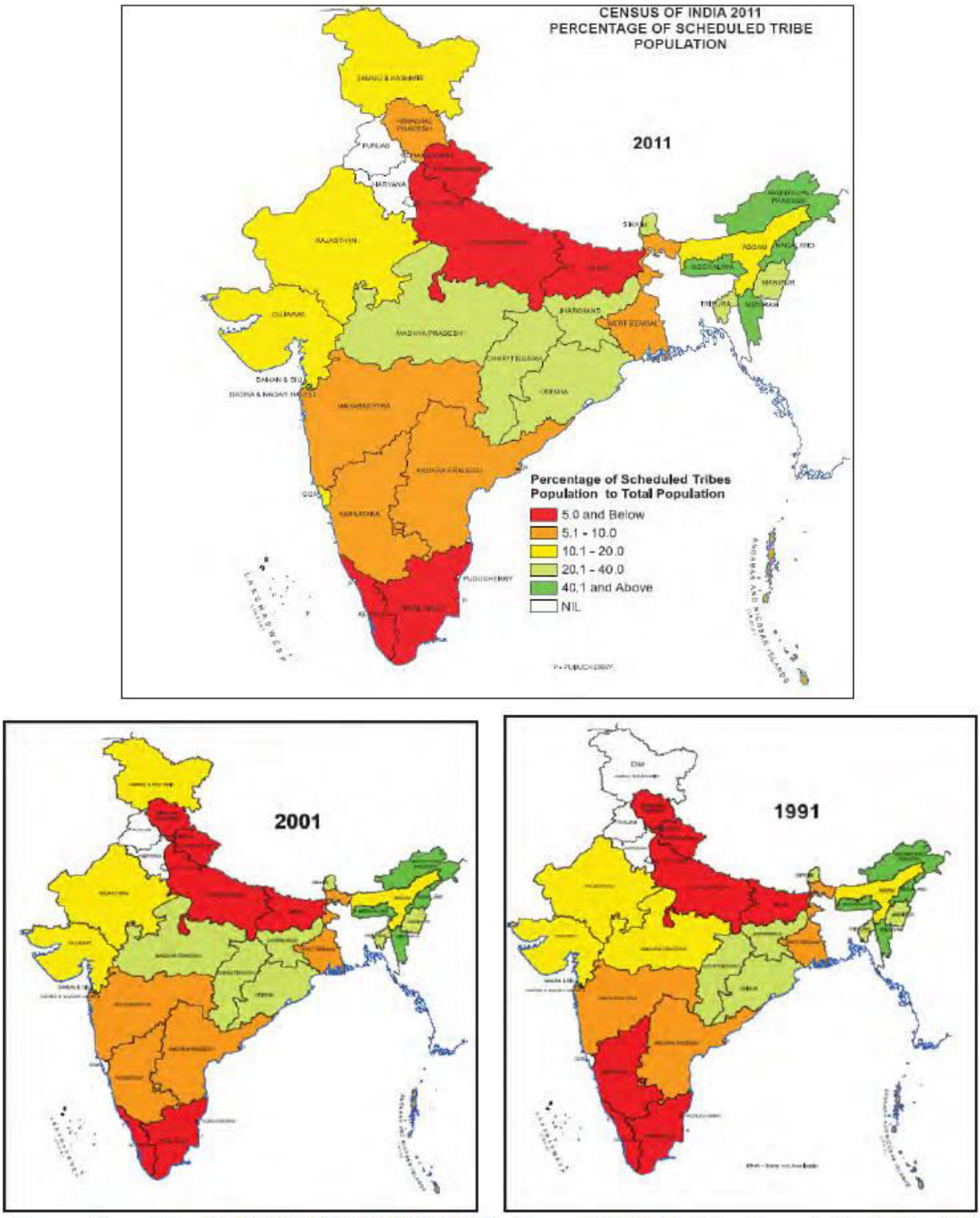
It can be seen from the Table 8.3 that more than two-third of the ST population is concentrated only in the seven States of the country, viz. Madhya Pradesh, Maharashtra, Orissa, Gujarat, Rajasthan, Jharkhand and Chhattisgarh. There is no ST population in three States (Delhi NCR, Punjab and Hariyana) and two UTs (Puducherry and Chandigarh), as no Sheduled tribe is notified. Among States, Mizoram has the highest proportion of Scheduled Tribes (94.43) and Uttar Pradesh has the lowest proportion of Scheduled Tribes (0.57) (Table 8.4)

17 States and 2 UTs have higher percentage of ST population than country's average of 8.6%. Table 4 gives State-wise comparison of Absolute number of All Population and Tribal Population in terms of Total, Male & Female and Table 5 gives the State-wise Tribal Population and decadal change by residence (Total, Rural & Urban) as per Census 2011.

Table 8.5: State wise Tribal Population and Decadal Change by Residence

State/ UT Code	India/ State/ Union Territory	Scheduled Tribe population 2011			Decadal change 2001-2011		
		Total	Rural	Urban	Total	Rural	Urban
	INDIA	104,281,034	93,819,162	10,461,872	23.7	21.3	49.7
1	Jammu & Kashmir	1,493,299	1,406,833	86,466	35	33.4	67.9
2	Himachal Pradesh	392,126	374,392	17,734	60.3	57.9	135.6
3	Punjab	NST	NST	NST	NST	NST	NST
4	Chandigarh #	NST	NST	NST	NST	NST	NST
5	Uttarakhand	291,903	264,819	27,084	14	10.2	70.1
6	Haryana	NST	NST	NST	NST	NST	NST
7	NCT of Delhi #	NST	NST	NST	NST	NST	NST
8	Rajasthan	9,238,534	8,693,123	545,411	30.2	29.4	43.6
9	Uttar Pradesh	1,134,273	1,031,076	103,197	950.6	976	750.4
10	Bihar	1,336,573	1,270,851	65,722	76.2	77.1	61.7
11	Sikkim	206,360	167,146	39,214	85.2	64	313
12	Arunachal Pradesh	951,821	789,846	161,975	35	30.3	63.8
13	Nagaland	1,710,973	1,306,838	404,135	-3.6	-15.4	75.7
14	Manipur	902,740	791,126	111,614	21.8	12.1	216.8
15	Mizoram	1,036,115	507,467	528,648	23.4	17.8	29.4
16	Tripura	1,166,813	1,117,566	49,247	17.5	15.5	93.7
17	Meghalaya	2,555,861	2,136,891	418,970	28.3	27	35.1
18	Assam	3,884,371	3,665,405	218,966	17.4	16.2	42.2
19	West Bengal	5,296,953	4,855,115	441,838	20.2	17.4	63.4
20	Jharkhand	8,645,042	7,868,150	776,892	22	21	32.3
21	Odisha	9,590,756	8,994,967	595,789	17.7	16.8	33.4
22	Chhattisgarh	7,822,902	7,231,082	591,820	18.2	15.4	68.2
23	Madhya Pradesh	15,316,784	14,276,874	1,039,910	25.2	24.7	32.1
24	Gujarat	8,917,174	8,021,848	895,326	19.2	16.8	45.7
25	Daman & Diu #	15,363	7,617	7,746	9.8	-31.9	175.8
26	D & N Haveli #	178,564	150,944	27,620	30.1	18.5	181.4
27	Maharashtra	10,510,213	9,006,077	1,504,136	22.5	20.3	37.9
28	Andhra Pradesh	5,918,073	5,232,129	685,944	17.8	12.6	81.9
29	Karnataka	4,248,987	3,429,791	819,196	22.7	16.9	54.7
30	Goa	149,275	87,639	61,636	-	-	-
31	Lakshadweep #	61,120	13,463	47,657	6.6	-58.2	89.8
32	Kerala	484,839	433,092	51,747	33.1	23.7	265.2
33	Tamil Nadu	794,697	660,280	134,417	22	19.8	34.2
34	Puducherry #	NST	NST	NST	NST	NST	NST
35	A & N Islands #	28,530	26,715	1,815	-3.2	-6.1	79.2

Figure 8.2: Spatial Distribution of Tribes in Indian States.



The data reveals that at all India level a decline of 32 percent is observed in the hundred percent groups of tribal villages. Among the states, maximum decline is noticed in Manipur, Meghalaya, Assam, Nagaland, Madhya Pradesh and Odisha in this category. In the next category of 90-100 tribal villages 5 percent rise is seen over the period 2001 to 2011.This is due to small rises in practically all the states. In the 75-90 group there is a marginal increase of 5 percent over the period 2001 to 2011 and the trend of state-wise distribution is similar to the previous group. In the next two groups of tribal villages 50-75 and 25-50 the statewise features and the all India growth pattern is more or less of the same order observed in the previous groups. Thus a significant feature that emerges during the period 2001 to 2011 is the decline in 100 percent tribal villages with marginal increases in the other classes of tribal villages.

8.3.2 STATE LEVEL DISTRIBUTION OF TRIBES IN INDIA

Since the tribes display a high tendency of clustering and concentration in the hilly and forested tracts of the country, they are highly unevenly distributed between the states of the Indian Union. On the basis of relief, the states and the union territories may be grouped into two categories: (a) those characterized by rugged topography, and (b) those with an open relief, (plains and river valleys). The tribes are heavily concentrated in the former and not in the latter. For example, Punjab, Haryana, Chandigarh, Delhi and Uttar Pradesh, which lie over the Indo-Gangetic plain and have a rich agricultural base, belong to the second category. They have either no tribal population or else the numerical strength of tribal population is negligible. In Uttar Pradesh, for example, the tribes are mostly concentrated in the hilly districts of Uttarakhand. Likewise, the tribes are either non-existent or their population is negligible over the plains of Bihar and West Bengal. On the other hand, tribes have a strong presence in the plateau region of southern Bihar. They are also predominant in the hilly districts of north Bengal as well as over the plateau districts of the states bordering on Bihar. Assam, despite being an extension of the North Indian Plain, supports a large chunk of tribal population. In fact, every eighth Assamese is a tribal. The southern states of Kerala, Karnataka, Tamil Nadu and Andhra Pradesh lie mostly in the plateau region and yet the population of tribes in these states is not very large. It varies from 1.03 per cent in Tamil Nadu to 6.31 per cent in Andhra Pradesh. The tribes are, however, numerically strong in the central Indian states from Gujarat and Maharashtra to Orissa and Bihar. Among them Madhya Pradesh has the highest proportion of tribal population, i.e., 23.27 per cent of the state's population, followed by Orissa (22.21 per cent), Gujarat (14.92 per cent), Rajasthan (12.44 percent), Bihar (7.66 percent) and West Bengal (5.60 percent).

Table 8.6: State wise Distribution of tribal villages by Different Concentration of Groups.

State	100% Tribals		> 90% Tribals		> 75% Tribals		> 50% Tribals		> 25% Tribals	
	2001	2011	2001	2011	2001	2011	2001	2011	2001	2011
Jammu & Kashmir	157	89	358	369	460	488	711	766	1168	1295
Himachal Pradesh	248	230	444	490	611	682	808	966	1011	1411
Punjab	-	-	-	-	-	-	-	-	-	-
Chandigarh	-	-	-	-	-	-	-	-	-	-
Uttarakhand	42	35	102	85	234	174	461	419	650	640
Haryana	-	-	-	-	-	-	-	-	-	-
Delhi	-	-	-	-	-	-	-	-	-	-
Rajasthan	1538	1152	3468	4456	4820	5701	6872	7763	9571	10654
Uttar Pradesh	20	23	49	124	63	197	74	340	93	623
Bihar	177	98	287	295	399	447	611	720	989	1155
Sikkim	4	2	12	17	36	51	77	138	178	285
Arunachal Pradesh	2165	2382	2894	3929	3144	4367	3378	4667	3555	4859
Nagaland	551	215	1105	1136	1201	1265	1247	1351	1271	1388
Manipur	1244	554	1586	1741	1663	1844	1694	1887	1722	1905
Mizoram	370	130	642	651	677	684	697	699	702	700
Tripura	123	22	302	301	377	385	451	466	549	564
Meghalaya	3944	1890	5257	5867	5460	6099	5575	6205	5621	6262
Assam	2772	1503	4309	4562	5107	5406	6311	6626	7689	8066
West Bengal	992	711	1601	1629	2302	2357	3900	3977	7256	7454
Jharkhand	3317	2451	6291	6370	8870	9008	12118	12239	15015	15171
Odisha	5085	3839	8688	8684	12249	12396	17531	17798	23000	23208
Chandigarh	1083	1076	3242	3200	5956	5926	9441	9418	12392	12298
Madhya Pradesh	2670	1619	7412	7338	10714	10687	14927	15022	20780	20927
Gujarat	1345	935	3446	3531	4007	4089	4934	4970	6089	6085
Daman & Diu	-	-	3	2	3	3	5	5	8	9
Dadra & Nagar Haveli	9	5	43	44	56	57	63	62	70	64
Maharashtra	1214	930	3614	3760	4785	4836	6640	6738	9944	10257
Andhra Pradesh	2407	1466	3812	3928	4444	4515	5239	5335	6589	6748
Karnataka	78	61	224	224	438	447	1032	1083	2799	3000
Goa	-	2	-	11	-	19	-	38	-	78
Lakshadweep	-	1	7	4	8	5	8	5	8	6
Kerala	-	-	-	-	-	-	5	6	25	26
Tamilnadu	75	46	210	231	267	282	323	320	391	391
Pondicherry	-	-	-	-	-	-	-	-	-	-
A&N Islands	112	41	141	77	157	84	163	89	167	93
All India	**31742**	**21508**	**59549**	**63056**	**78508**	**82501**	**105296**	**110118**	**139302**	**145622**

Source:Census of india 2001,2011

The northeastern states stand out as a category in themselves as the population in these states is predominantly tribal, although the numerical strength of tribes is not very large. Tribal proportion is particularly high in Mizoram, Nagaland and Meghalaya (85-95 per cent) and significantly high in Arunachal Pradesh (64 per cent). On the other hand, about one-third of the population in Tripura and Manipur consists of tribes. The share of tribal population is overwhelmingly large in certain union territories, such as Dadra and Nagar Haveli and Lakshadweep. On the contrary, the proportion of tribes in the population of Andaman and Nicobar Islands is insignificant (Table 8.6).

Evidently, tribal communities have either by their choice favored concentration in inhospitable environments, or conversely the peasant societies have pushed them and confined them to these enclaves thus having free access to the potentially rich lands suited pre-eminently to the agricultural pursuits. This, by and large, mutual exclusivity of the tribal and the peasant modes is an important attribute of spatial distribution of social categories in India.

Table 8.7: Number of Districts, Tehsil and Villages in Different Deciles Groups.

decile limit*	district count		tehsil count		village count	
	2001	2011	2001	2011	2001	2011
0 - 10	356	369	3479	3596	415443	411663
10 - 20	75	74	598	626	28661	29800
20 - 30	31	42	274	337	18735	19299
30 - 40	19	24	153	199	13954	14601
40 - 50	18	21	145	164	11554	12002
50 - 60	18	16	131	158	10771	11332
60 - 70	14	17	139	175	10513	10729
70 - 80	13	16	115	131	11167	11400
80 - 90	9	16	103	141	13296	13601
90 -&above	31	45	275	458	59549	63056
All	**584**	**640@**	**5412**	**5985@**	**593643**	**597483**
* *Lower limit included*					*Source: Census 2001,2011*	
@ There are 9 district and 106 tehsils with no rural poplulations						

It may be observed that the tribes are conspicuous by their absence in 36 districts mostly lying over the North Indian Plain. As noted earlier, the states of Punjab, Haryana, and the union territory of Chandigarh as well as the National Capital Territory of Delhi have no scheduled tribes as such. This is anomalous. They may be found there as immigrants but not recognized as scheduled tribes. The other states of the North Indian Plain, viz., Uttar Pradesh, northern and central parts of Bihar and West Bengal generally follow the same pattern with tribal share in population being negligible, less than one percent. This means that over most of Uttar Pradesh

groups or individuals may be enumerated as tribes, even though their status may be in-migrant. This is also true for the alluvial plains of Bihar and West Bengal.

List of Major Tribes in India: State Wise

1. Andhra Pradesh: Andh, Sadhu Andh, Bhagata, Bhil, Chenchus (Chenchawar), Gadabas, Gond, Goundu, Jatapus, Kammara, Kattunayakan, Kolawar, Kolam, Konda, Manna Dhora, Pardhan, Rona, Savaras, Dabba Yerukula, Nakkala, Dhulia, Thoti, Sugalis.

2. Arunachal Pradesh: Apatanis, Abor, Dafla, Galong, Momba, Sherdukpen, Singpho.

3. Assam: Chakma, Chutiya, Dimasa, Hajong, Garos, Khasis, Gangte.

4. Bihar: Asur, Baiga, Birhor, Birjia, Chero, Gond, Parhaiya, Santhals, Savar.

5. Chhattisgarh: Agariya, Bhaina, Bhattra, Biar, Khond, Mawasi, Nagasia.

6. Goa: Dhodia, Dubia, Naikda, Siddi,Varli.

7. Gujarat: Barda, Bamcha, Bhil, Charan, Dhodia, Gamta, Paradhi, Patelia.

8. Himachal Pradesh: Gaddis, Gujjars, Khas, Lamba, Lahaulas, Pangwala, Swangla.

9. Jammu and Kashmir: Bakarwal, Balti, Beda, Gaddi, Garra, Mon, Purigpa, Sippi.

10. Jharkhand: Birhors, Bhumij, Gonds, Kharia, Mundas, Santhals, Savar.

11. Karnataka: Adiyan, Barda, Gond, Bhil, Iruliga, Koraga, Patelia, Yerava.

12. Kerala: Adiyan, Arandan, Eravallan, Kurumbas, Malai arayan, Moplahs, Uralis.

13. Madhya Pradesh: Baigas, Bhils, Bharia, Birhors, Gonds,Katkari, kharia, Khond, Kol, Murias.

14. Maharashtra: Bhaina, Bhunjia, Dhodia, Katkari, Khond, Rathawa, Warlis.

15. Manipur: Aimol, Angami, Chiru, Kuki, Maram, Monsang, Paite, Purum, Thadou.

16. Meghalaya: Chakma, Garos, Hajong, Jaintias Khasis, Lakher, Pawai, Raba.

17. Mizoram: Chakma, Dimasa, Khasi, Kuki, Lakher, Pawai, Raba, Synteng.

18. Nagaland: Angami, Garo, Kachari, Kuki, Mikir, Nagas, Sema.

19. Odisha: Gadaba, Ghara, Kharia, Khond, Matya, Oraons, Rajuar, Santhals.

20. Rajasthan: Bhils, Damaria, Dhanka, Meenas(Minas), Patelia, Sahariya.

21. Sikkim: Bhutia, Khas, Lepchas.

22. Tamil Nadu: Adiyan, Aranadan, Eravallan, Irular, Kadar, Kanikar, Kotas, Todas.

23. Telangana: Chenchus.

24. Tripura: Bhil, Bhutia, Chaimal, Chakma, Halam, Khasia, Lushai, Mizel, Namte.

25. Uttarakhand: Bhotias, Buksa, Jannsari, Khas, Raji, Tharu.

26. Uttar Pradesh: Bhotia, Buksa, Jaunsari, Kol, Raji, Tharu.

27. West Bengal: Asur, Khond, Hajong, Ho, Parhaiya, Rabha, Santhals, Savar.

28.Andaman and Nicobar: Oraons, Onges, Sentinelese, Shompens.

29. Little Andaman: Jarawa.

30. North-East: Abhors, Chang, Galaong, Mishimi, Singpho, Wancho.

8.3.3 DOMINANCE AND DISPERSION

There are 24 districts in which the tribal share in population is overwhelmingly large; in fact, the tribes are in a dominant position. Twenty-one of them lie in the northeast. The remaining three districts are situated in Madhya Pradesh Jhabua, Gujarat (Dangs) and Lakshadweep.

Closer to these districts of high dominance is another set of 27 districts in which the tribes have a majority in the district populations, i.e., 50-80 per cent. Many of them are contiguous to the districts of the first category. The geographical distribution is somewhat different. For example, 14 of them are situated outside the northeast. They lie in the states of Bihar, Orissa, Madhya Pradesh, Rajasthan, Gujarat and Hirnachal Pradesh as well as in the union territories of Dadra and Nagar Haveli and the Andaman and Nicobar Islands. These districts include Dadra and Nagar Haveli (UT), Lahaul and Spiti (Himachal Pradesh), Banswara (Rajasthan), Gumla (Bihar), Bastar (Madhya Pradesh), Dungarpur (Rajasthan), Nicobars (UT), Mandla (Madhya Pradesh), Mayurbhanj (Orissa), Lohardaga (Bihar), Kinnaur (Himachal Pradesh), PashchimiSinghbhum (Bihar), Valsad (Gujarat), Koraput (Orrisa), Sarguja, Dhar (Madhya Pradesh) and Sun.dargarh (Orissa).

Together these 51 districts share among themselves 27 per cent of the country's tribal population. These tribal majority districts outside the tribal states of the northeast deserve special reference.

8.3.4 RURAL-URBAN DISTRIBUTIONS

Tribes are mostly a rural phenomenon. This is evident from the fact that about 93 per cent of the tribal population lives in rural areas. Bihar is closest to this national average. States which lie above the national average include Uttar Pradesh, Arunachal Pradesh, Orissa, West Bengal, Madhya Pradesh, Rajasthan, Kerala, Assam, Himachal Pradesh and Tripura. The tribes of Tripura are almost wholly rural as 98 per cent of their population is concentrated in villages. This

high rural proportion shows that the tribes are mostly engaged in primary economic activity and they are naturally located in the rural areas. On the other end of the scale is Mizoram with only about one- half of its tribal population being rural. The tribal population in Tamil Nadu, Nagaland, Maharashtra, Meghalaya and Karnataka is largely rural, with the rural proportion ranging between 85 and 87 per cent. It is only in Mizoram that the tribes have been significantly drawn into the urban way of life.

Even though the proportion of urbanized tribes is low in general, their numerical strength is sizeable i.e.more than five million as in 2011. About one-half of this population was living in the cities and towns of Maharashtra, Madhya Pradesh, Gujarat and Bihar alone. In terms of the numerical strength of urban tribes, Maharashtra holds the first rank, followed by Madhya Pradesh, Gujarat and Bihar. Then, there is the case of northeastern states where, as in Mizoram, the urban proportion is high, although the absolute urban population is low in comparison to the mid-Indian states. Tribal urbanization may be seen as an example of rural push rather than urban pull. Mizoram, of course, is an exception. In other states of the country like their non- tribal counterparts, the tribes have been pushed into the urban domain by largely unfavorable conditions prevailing in the home villages. These include deteriorating man-land ratio, caused by land alienation, stringent forest policies denying the tribes their natural right to the forest, location of big or small river valley/industrial projects in tribal areas leading to displacement and the emergence of contractor- ship in the tribal labor market. Thus, a chunk of the urbanized tribes in an Indian city may consist of contractual laborers as well as those ousted from the development project sites. There is evidence to show that the urban economies have accommodated the tribes only marginally. They are mostly unskilled labourers engaged in low-paid jobs and living in squatter colonies. In the city they are perhaps the poorest among the poor. The towns in the North-east may be an exception to this generalization.

8.3.5 PROBLEM OF TRIBAL AREAS

1. Problems with Land Alienation: Land as a prime resource has been a source of problem in tribal life because of two related reasons, first, Dependency, i.e. tribal dependency on land and second, improper planning from government agencies. Tribal people in India can be classified on the basis of their economic pursuits in the following way: Foragers, Pastoral, Handicraft makers, Agriculturists, Shifting hill cultivators, Labourers and Business pursuits. All of these occupations involve direct or indirect dependency on land. Land rights and changes in rules go unnoticed. Tribal are unaware or are made unaware about the rules which governs India's land rights. The tribe's do not have access to land records, not even the Record of Rights. This lends them to a higher probability of getting exploited, by the non-tribal and in some cases by the local officials. Wherever lands are given yet the pattas are not given, or pattas handed over yet the land is not shown. There is a discrepancy in demarcation of Scheduled Areas. In some places, it is village wise and in some places, it is area wise. There should be a clear village-wise demarcation of the Scheduled Area to avoid ambiguities and exploitation of tribal lands. Some of the tribal villages

surrounding the Scheduled Areas are administratively called the Tribal Sub-Plan Areas, where land alienation is high and has numerous pending cases. Land restoration and issuing title deeds to tribal's as per Land Transfer Regulation (LTR) Act should be implemented immediately in all these areas. This issue has to be immediately addressed, since only land situated in those villages that fall within the Scheduled Areas enjoy the protection under the LTR Act 1/70 in Andhra Pradesh. The Agency Revenue Divisional Officers serve as judicial magistrates and conduct agency courts in the Scheduled Areas. They are not knowledgeable of judicial matters and LTR, as they are posted from the Revenue Department. Because of their inexperience, numerous land alienation cases are pending in such courts. Some such SDCs are given charge of more than one district, or have to deal with both plain areas and scheduled areas, causing all sorts of logistical and experiential problems. They need to be trained in their LTR and judicial roles effectively. The revenue authorities (SDCs) are not restoring lands back to tribal's even after High Court issued orders. The implementation of the LTR Act seems to be restricted to small non-tribal land holdings, while the big landlords with huge tracts of tribal land remain unaffected. Lands are being taken over by non-tribal; while the tribal's have no access to their ancestral lands. In fact, The Endowments department has plans to auction such lands to private bidders. These developments are in contravention of the Fifth Schedule and the LTR Act and therefore such moves should be withdrawn forthwith. Non-tribal's are using Court stay orders, and even acknowledgements from the High Court to halt the restoration of lands in LTR cases. Steps need to be taken to ensure that stay orders do not stall the restoration process. One possibility would be to enshrine the LTR Act under the IX Schedule of the Constitution. Non-tribal's are taking possession of lands in Scheduled Areas by marrying tribal women. Most often, the tribal women, who are legal owners of lands and yields, become concubines and are denied all enjoyment over such rights by the non-tribal men. The children of a non-tribal father should not be given tribal status as most of the tribal groups in the country follow a patriarchal system of identity and ownership over property. It was felt that this system should be followed in the tribal area as well in order to prevent land alienation. Section 3(1) of LTR Act should be accordingly amended prohibiting transfer of land to children of tribal women married to non-tribal men. Land alienation within tribes is a serious problem. A special protection should be provided for the local tribes by a process of categorization of tribes both for the purpose of preventing land alienation from lesser-developed tribes, and for a more equal distribution of reservations and other constitutional provisions. As commons are difficult to manage, tribal people have frequently been denied from their rights over land. Their compulsion leads to a situation where tribals purchased seeds and other components from local money lenders in loan which ultimately displaced them from their lands due to chronic indebtedness. The unsatisfactory state of land records contributed a lot to the problem of land alienation. The tribal's were never legally recognized as owners of the lands which they cultivated. The second form of land alienation is reported to have taken place due to 'benami' transfers. Another form of land alienation is related to the leasing or mortgaging of the land. To raise loans for various needs the tribal'shave to give their land as mortgage to the local moneylenders or to the rich farmers. Encroachment is another

form of dispossessing the tribal's of their lands and this is done by the new entrants in all the places where there were no proper land records. Bribing the local Patwari for manipulating the date of settlement of land disputes, ante-dating etc., are resorted to claim the tribal lands. However, being the natural owners of forests and its adjoining lands the tribal's are being deprived of their rights to own them. They have been relegated from their earlier 'self-reliant' status to a 'dependent' one. Coupled with the exploitation by the non-tribal, the State legislations also proved detrimental to their interests. Therefore to understand the root causes of the land alienation process of the tribal communities its relationship with the changes in the socio-economic structures have to be understood properly. Strong tribal movements and protests have resulted is Supreme Court's decision of forming 6th schedule and 5th schedule to protect tribal people from outsider's exploitation. Analysis of forest policies show historically forest has been seen as a commodity. It was a view primarily related to colonial administrators. In post-colonial period forest is continued to be viewed as a commodity but there was substantive concern for forest protection. This protection initiative ultimately resulted in forest protection at the expense of tribal rights. Indian tribes have historical connection with forest. They are functionally and emotionally attached to the forest. Functionally they collect Food, Fuel and Fodder three most vital ingredient of their daily life. The Forest Charter, 1855 first time put restriction on the exploitation of forest by tribal people. Subsequently acts of 1878, 1898, 1927 and 1935 have systematically reduced tribal access to and command over forest. While tribes gradually lose their access increasing commercial exploitation increased. After independence, the nature of the acts remained largely the same until 2006. When the demands of modern industries situated outside the tribal areas led to the commercial exploitation of forests. These became then an important source of revenue in the state, and to regulate the extraction of timber and other produce large forest areas were designated as "reserved" and put under the control of a government department. Tribal communities dwelling in enclaves inside the forest were either evicted or denied access to the forest produce on which they had depended for many necessities. Thus arose a conflict between the traditional tribal ownership and the state's claim to the entire forest wealth. Numerous revolts were the direct result of the denial of the local tribal's right in the forests which they had always considered their communal property. While they were forbidden to take even enough wood to build their huts or fashion their ploughs, they saw contractors from the lowlands felling hundreds of trees and carting them off, usually with the help of labour brought in from outside. Where tribal's were allowed access to some of the forest produce, such as grass or dead wood for fuel, this was considered a "concession" liable to be withdrawn at any time. The traditional de facto ownership of tribal communities was now replaced by the de jure ownership of the state, which ultimately led to the exploitation of forest resources with total disregard for the needs of the tribal economy. However, in 2006 India reasserted tribal's access and rights over forest land on which they have depended for centuries. Landlessness has been arguably the major cause of indebtedness among the agriculturist tribal's. In India 58% of the tribal people Below Poverty Line (BPL) with a high concentration in states like Andhra, Rajasthan, UP, Bihar, Orissa and West Bengal. The land alienation with its long

history has natural consequence of indebtedness, which further lead to dispossession of tribal land. The poverty, land alienation indebtedness and landlessness is working a cyclical way. Economically indebtedness is an outcome of deficit family income and social compulsions. Since ethnographic study has shown the self-contained tribal life among the hunters and gatherers and their lack of concept of loan and interest, it is reasonable to believe that indebtedness is an outcome of interaction between non tribal and tribal people. The tribal lack of education and understanding of loan and interests have provided the incentives to the non tribals to systematically exploit them.

2. Bonded Labor: Slavery convention (1926) and International Labor Organization (ILO) (1930) argue forced labor, bonded labor is to be defined on the basis of labor and services extracted from a person as a penalty where the person has not involved voluntarily. United Nations sees characteristically more complex. Major reasons of bonded labor are– Link between caste, social structure and bondage, traditional feudal social relations and bonded labor. Small scale and localized quarrying and mining invite laborers from nomadic tribes and rural poor. They are irregularly paid and are made bonded without proper work place protection. Instances are reported from Haryana, U.P, M.P, Rajasthan, Karnataka and Tamil Nadu. India has a strong and substantivistic bonded labor abolition act of 1976. It recognizes:

a. overlap between forced and bonded labor,

b. contract labor and interstate migration issues,

c. embeddedness within social customs. However, since states showed reluctance and it is challenging to identify bonded labors, Supreme Court have tasked National Human Rights Commission for monitoring the implementation of the act.

3. Issues Related to Health: Malnutrition, as expected, is the most common health problem among tribal. In addition, communicable diseases such as tuberculosis, malaria, and STDs are major public health problems. Some tribal groups are also at high risk for sickle cell anemia. Generally tribal diets are seen to be deficient in protein, iron, iodine, and vitamins. According to the NFHS survey 47%, of tribal women are having chronic energy deficiency (CED) compared to 35% among the general population. The most common diseases seen among tribals are respiratory tract infections and diarrheal disorders. 21% of children suffer at least two bouts of diarrhea every year and 22% suffer from at least two attacks of respiratory infections. Tribal's account for 25% of all malaria cases occurring in India and 15% of all falciparum cases. Intestinal helminthiasis is widely prevalent among tribal children (up to 50% in Orissa and 75% in MP). Skin infections such as tinea and scabies are seen among tribal's due to poor personal hygiene. Sexually transmitted diseases are relatively more common (7.2% prevalence of syphilis among Kolli hills tribal's of Tamil Nadu). The prevalence of tuberculosis is high, especially in Orissa. Sickle cell trait prevalence varies from 0.5% to 45%, disease prevalence is around 10%. It is mostly seen among the tribal's of central and southern India, not reported in North-East. The

prevalence of tobacco use is 44.9% among tribal men and 24% among tribal women. Tribal people from their basic ways of living remote places and shyness of mixing with community at large frequently are worst sufferers of health hazards. The per capita health expenditure among tribal is higher than regular population. The available health infrastructure, i.e. number of health care centre's, professionals, and distance is considered to be determinants of the quality of health care facilities available. However, many recent studies have shown that sometimes; even if, health care facilities are available tribal tend to depend on their traditional system.The World Health Report (2000), therefore have stressed on the importance of health delivery in health outcomes, also stressing on the awareness generation about hygiene and available health infrastructure. The role of indirect intervention where removal of chronic poverty and a culture change was thought to be the prime factor for improvement of health and hygiene. At the time of independence the Government system of health care was wholly urban centered. The rural areas depended on traditional faith healers and voluntary agencies especially those of missionaries. The importance of making health service facilities available at micro level with more emphasis on tribal's. As a result the health issues are dealt by clubbing them together with nutrition, sanitation, family planning, health education, awareness generation etc. The village community health workers chosen by village people it now follows a decentralized agenda.

4. Problem of Illiteracy: The rate of illiteracy among the Scheduled Tribes has been very low. Almost 90 per cent of the tribal people are illiterates in 1961.The literacy level range from 8.5 per cent to 16, 3 per cent among the Scheduled Tribes during 1961-1981. The levels of literacy among females rose from 3.2 per cent to 8.04 per cent during the last decade. Education helps all-round developments of mind, body, culture and ultimately leads to the welfare of individual and society, through with people can enjoy the economic fruits of their efforts. Economic development of a nation always depends on education. If people are illiterate, the concerned authorities cannot implement strict economic policies and programmes. Prior to 1950, the Government of India had no direct programme for the education of tribal people.With the adoption of the constitution, the promotion of Scheduled Tribes has become a special responsibility of both the Central and State Governments. Educational opportunities have not been equal for all, especially the tribal's. Most of the tribal children out of the race under severe handicaps owing to circumstances of family, peer group or social environment. For a tribal family, to send its grown up girl or boy to school is essentially a matter of economics, and entails dislocation in the traditional pattern of division of labour.Many parents cannot just afford to send their children to school. Lack of education is a stumbling block to the tribal's in attaining a higher standard of life. Though some of the tribal settlements have elementary schools within short distances and though education is free, many tribals refrain from sending their children to schools due to many reasons-1, Loss of good chunk of their labor force, 2. The fear of expenditure on educationand 3. The problem of motivating the children to take their studies seriously is the most important amongst them (Jacob John Kaltaka, 1983).

5. Problem of shifting Cultivation: Shifting cultivation is a practice prevalent throughout the world, particularly in hill areas, inhabited by tribals. In shifting cultivation, cultivators do not stick to a particular piece of land for cultivation. A patch of land is selected; all the shrubs herbs and trees are cut down and then set on fire. The clearings thus obtained are taken up for cultivation. This type of tillage known to anthropologists as slash and burn, or swidden cultivation. Shifting cultivation which is known by different names; Jhum in Assam and Tripura, Bewar or Oahiya in Madhya Pradesh, Koman or Bringu in north Orissa; Gudia in south Orissa and Podu in Andhra Pradesh. It has been estimated by some scientists that about 2.6 million tribal people living in the interior hilly areas, practice shifting cultivation in India. About 1.35 million acres of land, in the states of Andhra Pradesh, Arunachal Pradesh, Assam, Meghalaya, Mizoram, Manipur, Madhya Pradesh, Nagaland, Tripura, Bihar, Orissa, Kerala and Karnataka is affected. Several tribes of Andhra Pradesh were traditionally podu cultivators. In the districts of Srikakulam, Visakapatnam, Khammam, Vest Godavari and East Godavari shifting cultivation is still the main method of tillage of a number of tribal communities and is carried on side by side with plough cultivation, wherever tribals are in a state of transition between the two systems. In East Godavari District, the areas under 'podu' are far larger, and mainly in the hills of Rampachodavaram mandal. Restrictions imposed by forest officials are here not very rigorous.

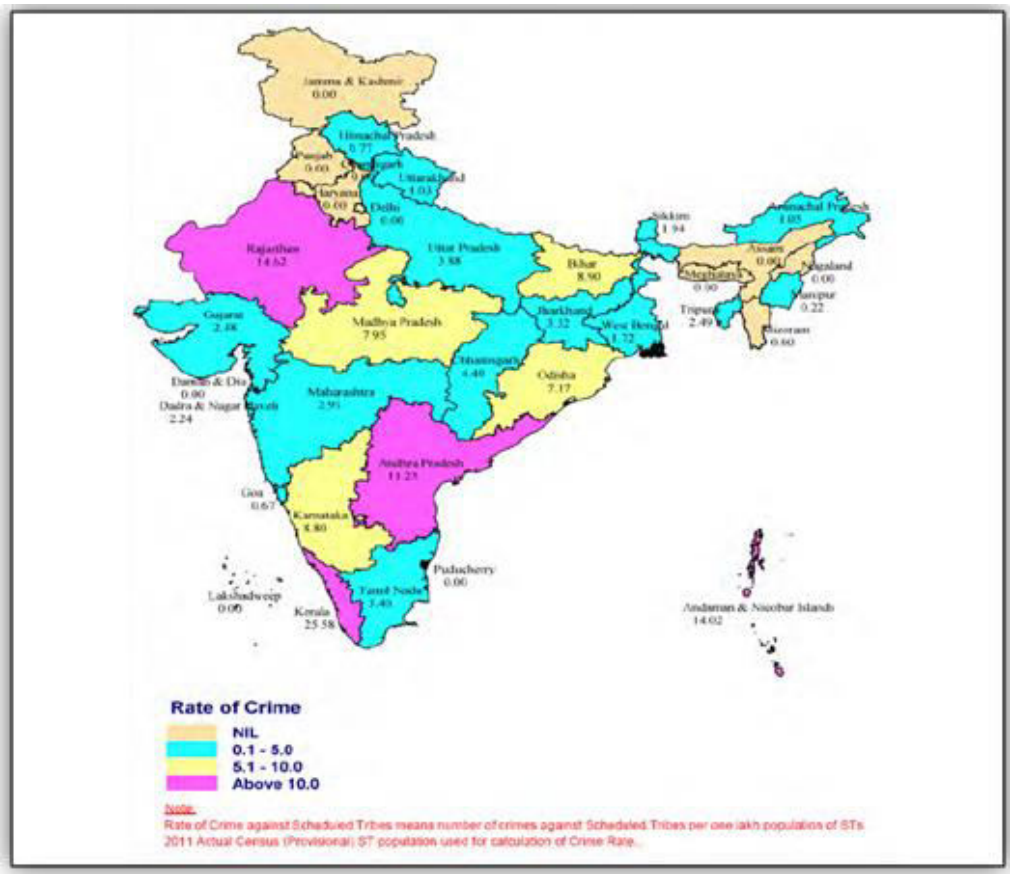
6. Economic Status: Tribal government programmes have not significantly helped the tribals in raising their economic status. The British policy had led to ruthless exploitation of the tribals in various ways as it favoured the zamindars, landlords, moneylenders, forest contractors, and excise, revenue and police officials.

7. Banking Facility: Banking facilities in the tribal areas are so inadequate that the tribals have to depend mainly on moneylenders. Being miserably bogged down in indebtedness, tribals demand that Agricultural Indebtedness Relief Acts should be enacted so that they may get back their mortgaged land.

8. Crimes against Tribal Population: India is committed to the welfare and development of its people in general and of vulnerable sections of society in particular. Equality of status and opportunity to all citizens of the country is guaranteed by the Constitution of India, which also provides that no individual shall be discriminated against on the grounds of religion, caste or sex, etc. Fundamental Rights and other specific provisions, namely, Articles 38, 39 and 46 in the Constitution of India stand testimony to the commitment of the State towards its people. The strategy of the State is to secure distributive justice and allocation of resources to support programmes for social, economic and educational advancement of the weaker sections in general and those of Scheduled Castes and Scheduled Tribes in particular. The Scheduled Tribes in India, constituting almost 8.6% of the total population, have not remained untouched from various crimes. They have been victims of countless crimes, both because of their gullibility and lack of hearing of their grievances. Looking at the year wise comparative data on the crimes committed against Scheduled Tribes, from 2006 to 20012, it is seen that: Murders decreased from 2006 to 2010 but increased in the year 2011 and 2012.The increase in murders in 2012 was

about 9.09% over the year 2011. Rapes decreased from 2006 to 2009 but increased in 2010 and 2011. However a marginal fall of 5.57% was noticed in 2012 over 2011. Similar trend was seen in case of Kidnappings and abductions with a sharp decline of 24.82% in 2012. Dacoity also registered a fall of 28.57% in 2012 over 2011 while Robbery rose significantly in 2012 over 2011 and from 2006 to 2007, Arson steadily decreased from 2008 to 2012 with an increase in 2010. The increase in Arson in 2012 was about 8.33% over the year 2011.

Fig8.3: Rate of Crime against Tribes in Indian States



8.4 SUMMARY

The solutions to the tribal problems mentioned above, have their own merits and demerits. The modern culture must not be imposed on them. Only those elements of new culture which may vitalize them for material advancement must be infused in them. Tribal problems are simple but very delicate to handle. No solution can be experimented with before winning the confidence of the tribal's. It is essential to establish a harmonious compatibility between the tribal mode of living and the material advancement of culture. The integration of the tribal society into the Indian society takes time, and it has to be promoted while retaining the good points of the tribal culture. Tribal people possess a variety of culture and they are in many ways certainly not backward. There is no point in trying to make them a second rate copy of ourselves.

We should unite and integrate the tribes in a true heart unity with India as a whole so that they may play a full part in their life. And the last is to develop welfare and educational facilities so that every tribesman may have an equal opportunity with the rest of the fellow citizens who work in the fields, factories, and workshops in the open country and the plains. The socio-cultural change among the tribal communities has no doubt empowered the tribal's; however, their cultural identity is under severe stress. However, it is not too late to rise above the politics of exclusion and marginalization, to unearth and mainstream fast vanishing tribal traditions, in India. Perhaps it's time to amplify long marginalized voices and awaken contemporary Nation States to the realization that only through the establishment of such democratic, reconciliatory, gender friendly grass root tribal traditions could one create a more equitable, more just society and world order. The reality remaining that without rapid action, these native communities may be wiped out, taking with them vast indigenous knowledge, rich culture and traditions, and any hope of preserving the natural world, and a simpler, more holistic way of life for future generations. However, it will only work, if the winners support with the losers.

8.5 GLOSSARY

1. Bards: Singing poets who recite verses about the legends Migrant Tribes / Nomads and history of their people.

2. Brachycephalic: Referring to a person with a comparatively broad head. Demography : The statistical analysis and description of populations considering vital aspects like age, sex, birth rate, death rate and mobility over a period or at one time.

3. Generic: Relating to or descriptive of an entire group or class.

4. People of India Project: The People of India Project launched by the Anthropological Survey of India in 1985 to present a brief but descriptive anthropological profile of all the communities of India, study the impact of change and development processes on these communities

8.6 ANSWER TO CHECK YOUR PROGRESS

1. The progress in tribal areas of India has been a mixed bag, with some regions witnessing significant improvements in recent years.
2. One of the key problems faced by tribal communities in India is land alienation, as their traditional lands are often taken away for various development projects.
3. Lack of access to quality education and healthcare facilities remains a pressing issue in many tribal areas, hindering their socio-economic development.
4. Unemployment and underemployment are common challenges, as tribal communities often lack the necessary skills for modern job markets.

5. Tribal populations often struggle to preserve their cultural heritage and traditions in the face of rapid urbanization and globalization.
6. Government initiatives like the PESA Act (Panchayats Extension to Scheduled Areas Act) aim to empower tribal communities by granting them greater control over local governance.
7. Efforts to improve infrastructure, such as road connectivity and electrification, have been made in some tribal areas to bridge the development gap.

\8.7 REFERENCES

1. Ahmad, A. (1999): Social Geography, Rawat Publications, New Delhi, pp. 122.

2. Banerjee, Maya (1976): Tribal Population of Singhbum, Geographical Review of India, Vol. 38, No.2, June, pp.179-186.

3. Census of India, District Census Handbook Dhule and Nandurbar Districts 1981,1991 and 2001

4. Chandana, R. C and Sidhu, M. S (1980): Introduction to Population Geography, Kalyani Publishers, New Delhi, pp. 203.

5. Chib, S. S. (1981): Tribal Population of India: A Geographical Interpretation, The National Geographical Journal of India, Vol. 27, Parts 3 & 4, Sept- Dec, pp 128-136.

Clarke, John (1972): "Population Geography", Pergamon Press, Oxford.

6. Gosal, G. S. (1982): Recent Population Growth in India, Population Geographer, Vol. 4 pp33-53.

7. Hornby, W. F and Jones, W. (1980): An Introduction to Population Geography, Cambridge University, Press, Cambridge, p.20.

8. Muzumdar, K. (1973) Distribution of Tribal Population in Eastern Gujarat, The National Geographical Journal of India, Vol. XIV (Parts 3& 4) pp 177.

9. Nagada, B. L (2001): Tribal Population and Health in Rajasthan, Studies of Tribes and Tribals", Kamal Raj Enterprises, New Delhi, Vol 2, No. 1 pp. 1-8.

10. Patil, V. B (1998): An Introduction to Tribal Culture and Tribals in Maharashtra, (ed), Tribal Research Bulletin. (Developmental 59 Scheme Special Issue), Tribal Research and Training Institute, Pune, Vol. XX No.1 Mar. 1998. pp. 1-6.

11. Ramesh, C. R (1965): Population Trends in the Malad, The Deccan Geographers, Vol. III, NO.1, p.67.

12. Ramotra, K. C and Mote, Y. S. (2009) Growth and Distribution of Tribal Population in Dhule and Nandurbar Districts of Maharashtra: A Geographical Analysis. Tribal Research Bulletin, Tribal Research and Training Institute, Pune Vol. XXXIII No. 1, pp 15- 24.

Ramotra, K. C. (2008): Development Processes and the Scheduled Castes, Rawat Publications, Jaipur.

13. Raza, Moonis and Aijazuddin Ahmad (1990). "An Atlas of Tribal India" Concept Publishing Company A/15-16 Commercial Block, Mohan Garden, New Delhi – 110059.

14. Sanyal, S. (1980): Some Demographic Aspects of the Scheduled Tribes of Andaman and Nicobar Islands, Man in India, Vol. LX. No. 34, pp.204-220.

15. Singh, R. N and Chaturvedi, R. B (1983): Dynamics of Population in Bundelkhand Region: A case Study, Journal of Association of Population Geographer.

16. Virginius,2003. Tribes in India in The Oxford India Companion to Sociology and Social Anthropology Edited by Veena Das; Oxford University Press: New Delhi.

17. Vidyarthi, L.P. and B.K. Rai. 1977. The Tribal Culture of India. Delhi: Concept Publishing Company

8.8 TERMINAL QUESTIONS

(A) Long Questions

1. Define tribe and explain its classification with suitable illustration.

2. What do you understand by tribes? Differentiate between tribes of north east and western India

3. Explain spatial distribution of Tribes in India

4. How the tribal population in India changing spatially and temporally, Evaluate.

5. What are the problems faced by tribes in India, describe.

(B) Short questions

1. What are tribal areas, and how are they distinct from other regions?

2. What are the major challenges faced by tribal communities?

3. How does lack of access to healthcare impact tribal populations?

4. What are the economic challenges commonly experienced by tribal people?

5. Write a short note on the distribution of tribal population in India.

6. How does cultural preservation and identity relate to tribal issues?

7. What is the impact of inadequate infrastructure in tribal regions?

8. Write a short note on the tribes of India.

9. What is status of banking facility in tribal area and how this is impacting their development?

10. What efforts can be made to address the problems faced by tribal populations?

(C) Multiple choice questions

1. What are tribal areas primarily known for?
A. Industrial development
B. Urbanization
C. Traditional and rural livelihoods
D. Education and technology
Answer: C

2. Which of the following is a common issue faced by tribal children in terms of education?
A. Access to quality schools
B. Overwhelming technological resources
C. Abundant learning materials
D. High literacy rates
Answer: A.

3. Land rights and ownership are significant issues in tribal areas because:
A. Land is abundant and easily accessible
B. Tribes typically don't use land for agriculture
C. Land is a crucial source of livelihood and identity
D. Land is not important in tribal culture
Answer: C

4. Inadequate healthcare infrastructure in tribal areas can lead to:
A. High life expectancy
B. Improved overall health outcomes
C. Health disparities and increased mortality rates
D. Equal access to healthcare services
Answer: C

5. What is an important aspect of tribal culture that needs preservation and support?
A. Assimilation into mainstream culture
B. Loss of traditional languages and customs

C. Urbanization and modernization
D. Access to modern technology
Answer: B

6. Which of the following is a common economic issue in tribal areas?
A. High income levels
B. Low poverty rates
C. Economic disparities and poverty
D. Abundant job opportunities
Answer: C

7. What role does government policy play in the development of tribal communities?
A. No significant role
B. Hindrance to progress
C. Can either promote or hinder development
D. Solely responsible for development
Answer: C

8. Environmental concerns in tribal areas often revolve around:
A. Limited access to natural resources
B. Overexploitation of resources
C. Lack of interest in environmental issues
D. Abundance of pristine ecosystems
Answer: B

9. How can tribal people be empowered in decision-making processes?
A. Through exclusion from decision-making
B. By prioritizing their input and participation
C. By imposing decisions from outside authorities
D. By discouraging their involvement in governance
Answer: B

10. What is the primary goal of addressing tribal area problems?
A. Cultural assimilation
B. Preservation of traditional practices
C. Ensuring sustainable development and well-being
D. Ignoring their unique needs
Answer: C

UNIT-9 POPULATION PROBLEM AND POLICIES

9.1 OBJECTIVES

After having the detailed study of this unit you will be able to:

- To explain population problems in India
- To describe population policies in India

9.2 INTRODUCTION

The term Population has been defined differently in different contexts. For social science the population can be defined as 'total number of people of a particular group, race, class, category (e.g. Population of Scheduled Castes, Scheduled Tribes, or religious groups) or of a specified area or territory (e.g. Population of world, country, state, city or village).

Population is a great human resource which paves way for technological, socio-economic and cultural development in a society. But its excess is a great curse which produce a wide variety of impediments to development and creates a number of problems. The genesis of the population lies in the excessive growth and over population. If the growth of population exceeds the optimum size of the population nourished by the economic and technological development of the region, it creates over population which is a universal problem in all developing countries of the world. Over population puts heavy pressure on existing factor endowments, especially natural resources of the community. This leads to resources depletion and crisis leading to economic retardation and deprivation. This also causes poor quality of life, low standards of living, mass poverty, disease and hunger. Similarly shortage of food, inadequate housing, lack of health care, mother care and family welfare facilities, illiteracy, unemployment, insanitation price rise, adulteration, hoarding, black marketing, theft, loot, strikes, lockouts, environmental pollution, political upheaval etc. are all related to explosive and uncontrolled population growth.

Every nook and corner of India is a clear display of increasing population. Whether you are in a metro station, airport, railway station, road, highway, bus stop, hospital, shopping mall, market, temple, or even in a social/ religious gathering, we see all these places are overcrowded at any time of the day. This is a clear indication of overpopulation in the country. According to the Indian census, carried out in 2011, the population of India was exactly 1,210,193,422, which means India has crossed the 1-billion mark. This is the second most populous country of the world after China and the various studies have projected that India will be world's number-1 populous country, surpassing China, by 2025. In spite of the fact that the population policies, family planning and welfare programmes undertaken by the Govt. of India have led to a continuous decrease in the fertility rate, yet the actual stabilization of population can take place only by 2050.

9.3 POPULATION PROBLEMS AND POLICIES

CONCEPT OF UNDER, OVER ANDOPTIMUMPOPULATION

1. Under Population: If the population of a country is below the optimum, i.e., below what it ought to be, then the country is said to be under-populated. Further, it can be stated that when the number of the people are insufficient to take the fullest possible advantage of the natural and capital resources of the country, the region can be called as under populated. In other words, under population occurs when a population is too small to utilize its available resources, or where resources could support a larger population with no reduction in living standards. Examples of under population are found in certain regions of low development such as areas of subsistence agriculture and pastoral nomadism etc. Under population is a situation whereby the size of the population is small in relation to available resources of the country. It is situation where the size of the population is below the equilibrium

Causes of under population:

1. An increase in Death Rate: Natural Catastrophes such as earthquakes, flood etc. will lead to an increase in death rate therefore the country witnesses a reduction

2. A fall in Birth Rate: When a country decides to reduce the number of children for fear of eventual overpopulation or any socio-political factor which does not favor children, the country becomes under-populated

3. High Level of Emigration: A persistent increase in emigration over immigration will leads to a reduction in a country population.

Positive effects of under population

1. No Congestion: A country with less population experiences little or no congestion

2. Employment Opportunities: As a result of small size of the population, there will be enough job opportunity for the people

3. Increased in Social and Infrastructural Facilities: An under Populated Country experiences a higher per capita in terms of social and infrastructural facilities available to the people in the country.

4. Availability of Idle Resources: The fact that a country is less populated means that the resource available in that country is higher than the number of people; hence, many idle resources would abound everywhere.

Negative Effects of under population

1. Lower Standard of Living: Under Population engender lower standard of living as a result of inadequate labor force that would have conveniently boost output and production of goods and services

2. Lack of Adequate Manpower: Under population results to shortage of labor with that attendant effect of low investments and income

3. Under utilization of Resources: Resources are highly underutilized in a country with low population

4. Lack of People to Defend the Country: At times of war and emergency, a country might find it difficult to mobilize enough people to defend it

5. Equilibrium at Less than Full Employment: Under population leads to reaching of equilibrium at less than full employment as a result of idle resources.

2. Over Population: Any area is over populated when the carrying capacity of an area is exceeded by its population. It means the area has more population than what it can support. Over population exists where there is an excess of population over utilized or potential resources. It may result from an increase in population or a decline in resources. Therefore, it means, over population occurs when resource development fails to keep pace with population growth. As there is no measurement of over population, it is simply characterized with low per capita income, high population density, low living standards, higher unemployment and outmigration. In extreme condition, the symptoms of over population are famine, poverty, hunger, malnutrition etc.

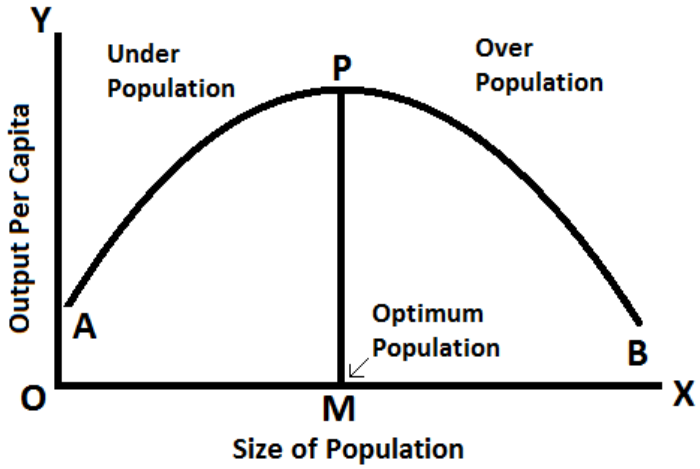
3. Optimum Population: Optimum population has been defined in several ways by different people. Cloud (1971) defined "optimum population as the one that lies within limits, large enough to realize the potentials of human creativity to achieve a life of high quality for all the inhabitants indefinitely, but not so large as to threaten dilution of quality or the potential to achieve it or the wise management of the ecosystem". Knowles and Wareing (2011) have defined optimum population as 'the size of population enabling maximum per capita output and the highest possible living standards under given economic and technological conditions' (Fig. 9.1).

Another definition says that by optimum population is meant the ideal number of the population that a country should have, considering its resources. The optimum means the best and the most desirable size of a country's population consistent with its resources. It is the right number. When a country's population is neither too big nor too small, but just that much which the country ought to have, it is called the optimum population. Therefore, it is clear that given a certain amount of resources, state of technical knowledge and a certain stock of capital, there

will be a definite size of the population at which real income of goods and services per capita will be the highest. This is the optimum size. The optimum number can, therefore, be defined as the one at which per capita income is the highest. Optimum population also refers to the size of a population that produces the best results according to chosen targets.

In present context, it can be defined as that size of population which the earth's carrying capacity can support and shall ensure the highest level of sustainable development in a region. The level of sustainable development here means that the relationship between man-nature is highly developed not at the cost of each other but in relation to each other. At present many countries are experiencing manmade problems due to the disregard of environment. For example flood is no more a natural disaster, pollution etc. These problems are limiting the rapid economic development of a region. In tackling these anthropogenic problems, the pace of economic development gets hampered. Therefore, optimum population is one which makes a region more comfortable with respect to maximum resource development plus the suitable environment for the living conditions of the local.

Fig. 9.1: Under, optimum and over population.



RELATIONSHIP BETWEEN UNDER, OVER AND OPTIMUM POPULATION

The resources are vast; much can be produced; but there are not men enough to carry on the work of production efficiently (state of under population). Under such conditions, increase in population will be followed by an increase in the per capita income. But this increase cannot go on indefinitely. When the shortage of man-power has been made up, the per capita income will reach the maximum, and we shall say that the optimum has been reached. If, the population still goes on increasing and the optimum is exceeded, then we shall have a state of over population. There will be too many people on the land. The resources will not be sufficient to provide gainful employment to all. They will be thinly spread over the teeming millions. Per capita income will

diminish; the standard of living will fall; war, famine and disease will be constant companions of such a people in the region.

It is generally agreed that a small manageable increase in population is not objectionable in an expanding economy. However, it is clear that beyond a certain level, population increase may become excessive, so that the economy gets exhausted and problems associated with over population such as poverty, malnutrition and starvation reach serious proportions. The problem lies in assessing when the optimum population for any given economy has been reached, or the point when population growth becomes excessive. Although, the determination of optimum population is difficult, it nevertheless seems clear that most of the developing countries have already passed this point.

9.3.1 POPULATION PROBLEMS

India is one of the densely populated countries of the world. It has to support about 15% of the world population, although its land area is merely 2.4% of the land area of the world. India's population stood at 1027,015,247 on March 1, 2001. The decennial census of 2001 indicates an addition of 181 mn. People between 1991 and 2001 but the rate of growth in this decade shows the sharpest decline (21.34%) since independence.

The exponential rate of growth of population (annual) in the decades 1991-2001 was 1.9% as against 2.1% the previous decade. But it was still higher than the assumptions regarding from 1.6 to 1.8% made by the planning commission.

The rate of population growth depends on the difference between the birth rate and the death rate. Thus, the population growth experienced in India can largely be explained by variations in birth and death rates.

The death rate continued to fall over the entire plan period. But the birth rate continues to remain high by current standards. As a result there has been a net addition to the size of the population.

A study of India's demographic trends during the last five decades reveals that the death rate has fallen much faster than the birth rate. The death rate has already fallen to a very low level (viz., 9.6 per thousand). There is no scope for reducing it further. But the birth rate continues to be high by current standards. Therefore, in future India's population will be a function of birth rate alone.

The Nature of India's Population Problem

The number of people which a country can support largely, if not entirely, depends upon its existing natural resources, the methods it uses in production, and the efficiency of labour which affects labour productivity. It appears from current standards that India should have about 400 million in 2002 instead of 1,027 million.

This excess population is itself a symptom of over-population. This problem is becoming more and more acute day by day due to rapidly increasing population— by about 22 million persons a year. So, India is over-populated.

However, a small minority of people see that India is not really over-populated because it is a vast country with plenty of natural resources. These resources have not been fully used as yet. They express the view that, if all the resources are fully employed, India can maintain a larger population than what it is having now and in much greater comfort. There is some truth in this argument. But one cannot deny the following facts:

1. The population of India is very large by current standards.
2. The rate of increase of population is also high i.e.about 2.22% per year, in absolute form this comes to nearly 22 million persons per annum.
3. Even the existing population is not being fed, clothed and housed properly; most people are living in miserable conditions.
4. The modest increase in national income under planned economic development is being eaten up by the increase in population. As a result, the per capita income growth has almost reached a vanishing point.
5. The need of controlling population is urgent and pressing so that the existing people may have an improved standard of living.
6. There is no denying of the fact that there were too many people now in India. However, the real problem is not the present large size of the population but the rate at which the size of population is increasing every year? India can progress, if— and only, if the continuous and huge increase in population is held in check.

Therefore, the major population problem can be described in following heads:

1. Poverty: Poverty is a greatest problem faced by developing countries like India. Roughly 302 million of our people, or 1 in 4, live below the poverty line. The data by National Sample Survey Organization (NSSO) are based on uniform recall period consumption i.e. per capita monthly consumption expenditure (Rural Rs. 356.30; Urban Rs. 538.60). Although there is percentage decline of people below the poverty line both in rural and urban areas. Still India has the highest poverty rate amongst major countries of the world.

Figure represents the state wise incidence of urban poverty. The distribution shows variation in poverty in different parts of the country. The lowest poverty, 5.4 percent, is recorded in Jammu and Kashmir while Orissa is characterized by the highest percentage of poverty (46.4). In Orissa, Bihar, Chhattisgarh, and Jharkhand more than 40 percent of the people live below poverty line. Uttar Pradesh, with 32.8% of population below poverty line, has the largest number of poor (59 million) in India. On the other hand southern states have lower poverty (20-30 percent). Lowest poverty can be seen in the western and northern states of the country.

Fig. 9.2 Picture showcasing Poverty in India

2. Malnutrition: There is a shortage of nourishment especially that of balanced diet in developing county like India. The standard of living is very low and housing conditions are often poor. The standard of living of hygiene and quality of nutrition are also often poor, which leads to many deficiency diseases. According to the Survey conducted by the National Sample Survey Organization in 2014-15, there has been decline in per capita intake of calories and protein between 1972-73 and 2004-05. A significant rise in per capita daily intake of fat is observed both in rural and urban areas during the same period. Since these data are at household level and do not reflect the dietary intake of the individual, especially women and children.

Among the factors influencing malnutrition may be made of: (a) physical environment (b) demographic variable, (c) socio-cultural factor, and (d) economic variable. While physical environment affects the crop variety, dietary habit and occurrence of diseases.

Demographic variables affect the quantity and quality of the food. For example, swamp, dense vegetation, heavy rainfall and excessive irrigated areas promote the origin of vectored diseases like Malaria and Filaria etc. Iodine deficiency in the mountainous and sub-mountainous regions enhances the incidence of endemic goiter in these areas. Seasonal changes also have role in the incidence of diseases. In general summer and rainy season promote the occurrence of diseases. The size of the family and spacing in the birth of children affects the per capita availability of food. In India poor and economically depressed household are generally larger in size and low spacing in the child birth.

Fig.9.3 Spatial Pattern of Poverty Rates in India

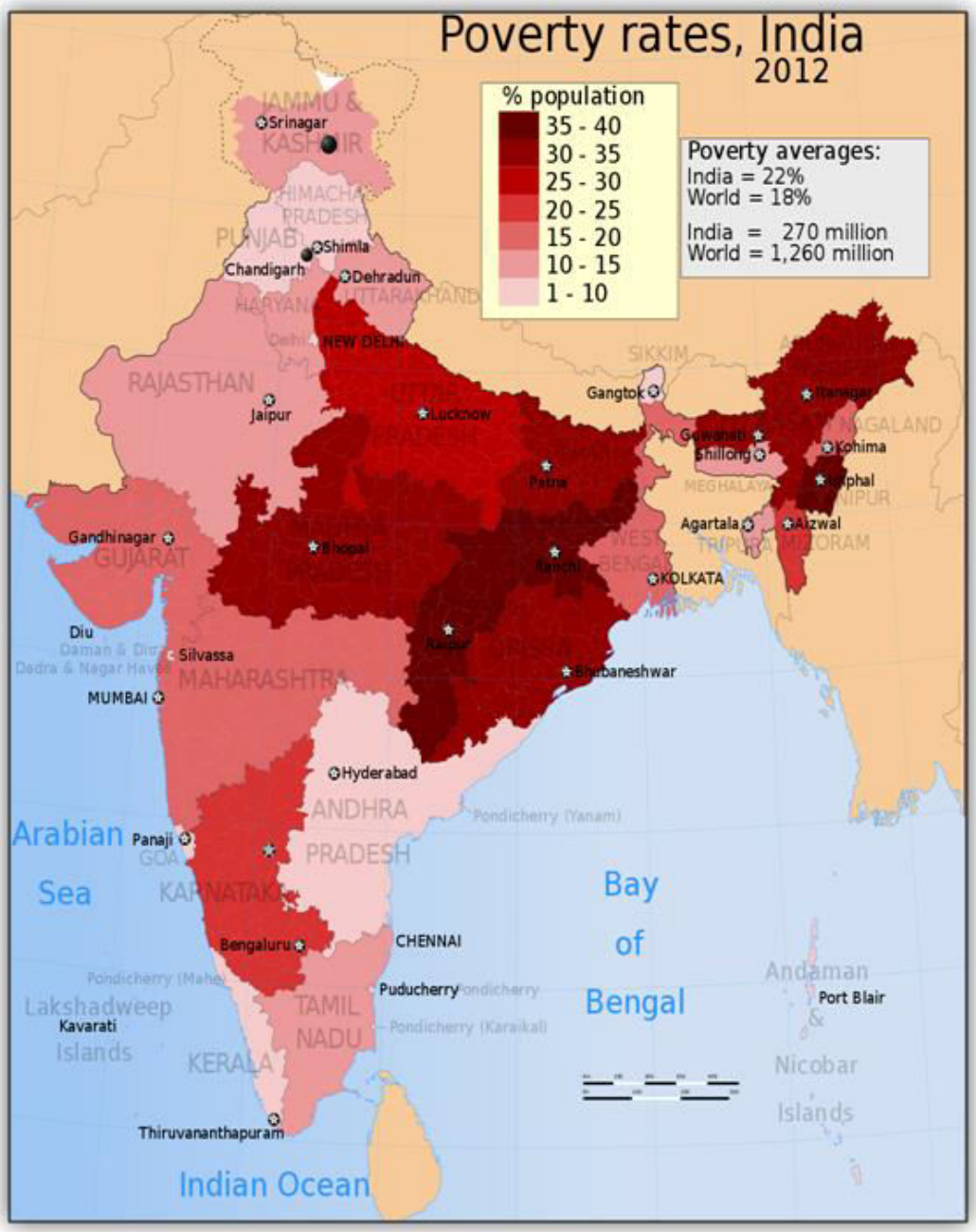
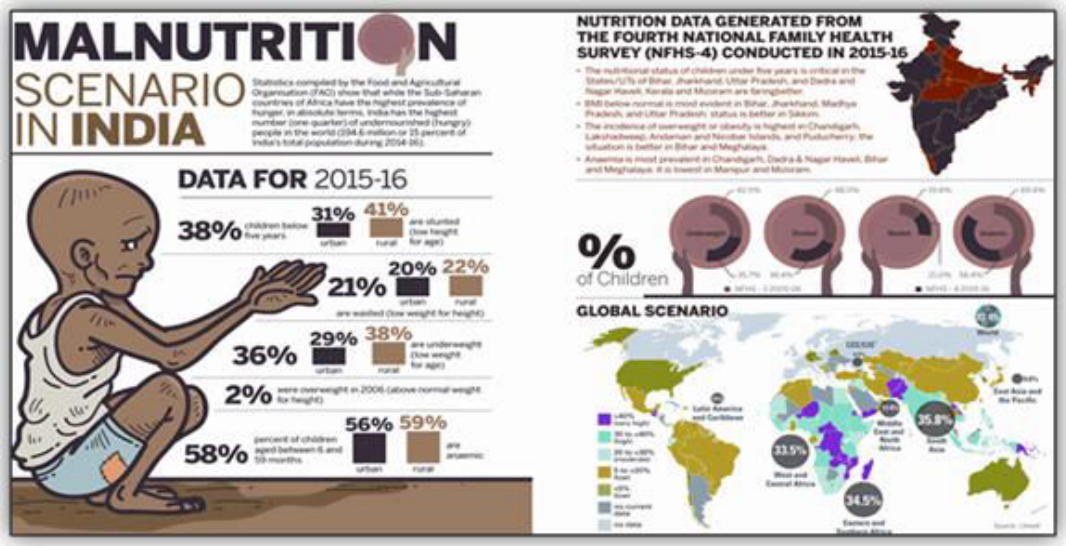


Fig. 9.4Facts on Poverty in India.

Fig. 9.5 Malnutrition Scenario of India.



In most of the states, the calories intake is higher in rural areas than urban areas, although the gap is not very large. However in the southern, central and eastern parts of the country urban areas consume more calories. In general the calories intake appears to decrease southwards and eastward into warmer region of the country.

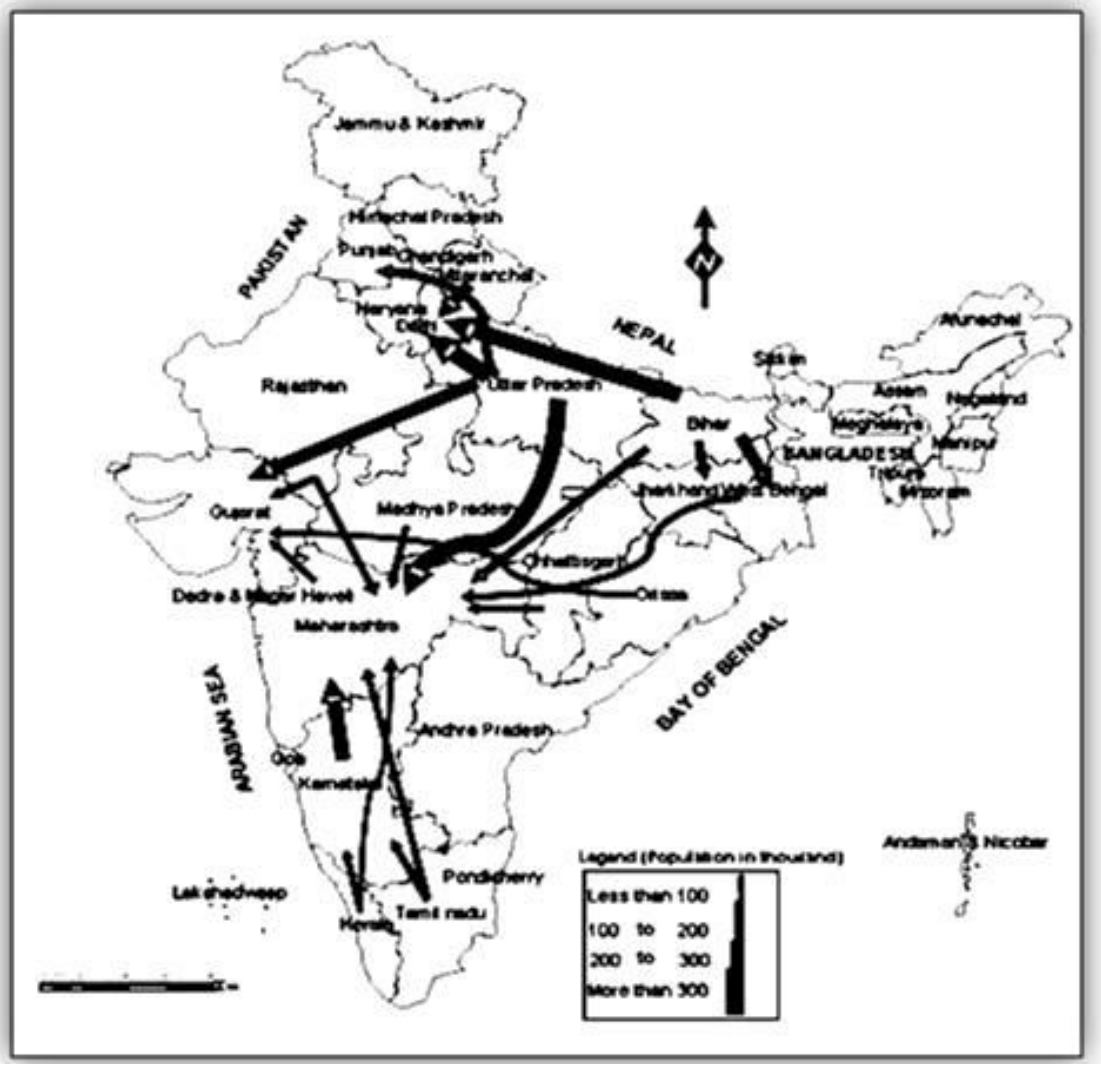
Food security is also one another side of the problem faced by Indian population. Food security refers to the availability of food and one's access to it. Food security exists when people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. It is based on two factor; (a) food availability and (b) purchasing power of the people. Worldwide around 852 million

people are chronically hungry due to extreme poverty, while upto 2 billion people lack food security intermittently due to varying degree of poverty. In India alone despite sufficient buffer stock of food grains, an estimated 200 million people are underfed and 50 million on the brink of starvation, resulting in starvation deaths. States like Bihar, Orissa, Madhya Pradesh, Chhattisgarh and Jharkhand show low levels of food security. Gujarat and Rajasthan, which have moderately food secure population in urban areas, exhibit severe insecurity in rural areas.

3. Migration: The term migration refers to the movement of population from one place to another. It may be of temporary or permanent. Temporary migration may be annual, seasonal or even of a shorter duration, like daily. Migration is not merely a relocation of human resources but it is a process which has three-fold impact: (a) on the area experiencing in-migration, (b) on the area experiencing out-migration, and (c) on the migrants themselves. The purpose of migration may be employment, business, education, family movement, marriage, calamity etc. According to 2011 Census, about 40 percent of migration is due to economic reasons, especially for seeking employment.

In India there is massive rural to urban migration towards metropolitan cities like Kolkata, Mumbai, Delhi, Chennai, Hyderabad etc. to seek employment, better economic prospects and education. Majority of these migrants are illiterates and semi-literates and un-skilled, who are compelled to leave their village home due to poverty and unemployment. Since, most of our cities have very limited employment generating capacity under capital-intensive industrialization and very limited absorptive capacity in the organized sector, these migrants find salvage only in informal sector, such as porters, domestic servants, hawkers, vendors, construction workers etc. Mukerji has termed this phenomenon of urban growth as 'involuntary urbanization'. It has led to the cancerous growth of shanty towns, slums, bastes and squatter settlements, overflow of urban employment, digression of per capita consumption levels of daily necessities very sharp decline of basic human values in extremely congested Indian metropolitan that have been speedily occurring over 1981 and which will accelerate in near future. Because of this unchecked influx India's mega cities and metropolitan are growing as a over blown villages, without essential urban function characteristics, urban infrastructure and services and without a strong economic base. The phenomenon is similar to urban decay and degeneration.

Fig. 9.6 Migration in India



4. **Dependency Ratio:** Dependency ratio denoted the number of dependents over the working-age population. It is of three types: (a) youth dependency ratio, (b) aged dependency ratio and (c) total dependency ratio. Table shows the changes in dependency ratio in India between 1950-2005. According to the table the total dependency ratio has shown rising trends upto 1970 but it is steadily declining onwards. This is due to sharp decline in youth dependency ratio between 1970-2005, although aged dependency ratio has shown rising trends.

Table 9.1: India: Dependency Ration.

Year	Youth	Aged	Total
1950	0.67	0.06	0.73
1960	0.70	0.06	0.76
1970	0.72	0.07	0.79
1980	0.67	0.07	0.74
1990	0.62	0.07	0.69
2000	0.56	0.08	0.64
2005	0.52	0.08	0.60
2011	0.48	0.09	0.60

Source: Office of Registrar General, India

At state level highest dependency ratio (0.95) is found in Bihar followed by Uttar Pradesh (0.93), Meghalaya (0.88), Rajasthan (0.88), Madhya Pradesh (0.84) and Jharkhand (0.84). on the other hand Daman and Diu (0.48) and Goa (0.49) have the lowest dependency ratio. Young dependency ratio almost follows the same pattern with the highest and the lowest values recorded in Bihar (0.82) and Daman and Diu (0.40) respectively. In the old dependency ratio Kerala top the list while Dadra and Nagar Haveli is in the bottom.

5. Mismanagement of Agricultural Resources: By and large, most of the developing countries like India have agrarian economy. The agriculture is mostly done by traditional methods; absolute equipment's had inadequate financial resources. Owing to the lack of funds and finances, the farmers are unable to apply chemical fertilizers and other inputs in required quantities. Consequently, the production per unit is low. The fragmentation and small size of holding and land tenancy systems are also some of the serious barriers in the modernization of agriculture. In such countries, land is their ultimate asset, is thus either underutilized or miss utilized. Many of the farmers, being tradition bound, do not accept the innovations and new ideas.

6. Orthodoxy: As said earlier, the people in the India are traditional bound, and less exposed to the outside world. Moreover, they are religious in their attitudes who do not accept easily new ideas and modern style of life. Being religious, they generally do not observe family planning. Birth control is forbidden by the Catholic Church in India, caste restriction on occupation also help to slow down transformation of society and process of development. For the removal of

such attitudes and for the eradication of blind faith and orthodoxy, large scale literacy and mass education are necessary.

7. Population and Environment: According to some research, environmental pollution is one of the serious problems faced by the people in the country. Rapid population growth, industrialization and urbanization in country are adversely affecting the environment. Though the relationship is complex, population size and growth tend to expand and accelerate these human impacts on the environment. All these in turn lead to an increase in the pollution levels. However, environmental pollution not only leads to deteriorating environmental conditions but also have adverse effects on the health of people. India is one of the most degraded environment countries in the world and it is paying heavy health and economic price for it. According to the World Development Indicators report in 1997, 1.5 billion people live exposed to dangerous levels of air pollution, 1 billion live without clean water and 2 billion live without sanitation. The increase of population has been tending towards alarming situation. The world's population was estimated to be 6.14 billion in mid 2001and projected 7.82 billion and 9.04 billion in the year 2025 and 2050 respectively. Contribution of India alone to this population was estimated to be 1033 millions in mid2001 which has been projected 1363 million and 1628 millions in 2025 and 2050respectively. (2001 World Population Data Sheet). According to the provisional results of the Census of India 2001, the population of India, on 1st March 2001, is 1027 millions.

IMPLICATIONS OF GROWING POPULATION IN INDIA

Population growth and its relation to economic growth has been a matter of debate for over a century. The early Malthusian view was that population growth is likely to impede economic growth because it will put pressure on the available resources, result in reduction in per capita income and resources; this, in turn, will result in deterioration in quality of life. Contrary to the Malthusian predictions, several of the East Asian countries have been able to achieve economic prosperity and improvement in quality of life in spite of population growth. This has been attributed to the increase in productivity due to development and utilization of innovative technologies by the young educated population who formed the majority of the growing population. These countries have been able to exploit the dynamics of demographic transition to achieve economic growth by using the human resources as the engine driving the economic development. Improved employment with adequate emoluments has promoted saving and investment which in turn stimulated economic growth. Following are the adverse effects of population growth on the Indian Economy:

1. Adverse effects on savings

2. Unproductive investment

3. Slow growth of Per Capita Income

4. Underutilization of labor

5. Growing pressure on land

6. Adverse effect on quality of population and

7. Adverse social impact

SOLVING THE POPULATION PROBLEM

One may suggest two measures for solving India's population problem. These are:

1. Birth control and
2. Accelerating the rate of growth of the economy.

The control of births seems to be the most common method of checking the growth of population. However, because of the low level of literacy and lack of general interest, family planning has not achieved much success so far.

Rapid economic development will surely answer our needs. In fact, China has achieved rapid growth in spite of population growth. People must be made to feel that their poverty is removable and they can enjoy all those things, which the higher income groups enjoy. Then only will they start working hard. Furthermore, they will adopt a small family norm, if they realise that a large number of children will definitely keep them poor and make them poorer.

But according to the theory of demographic transition in the initial stages there is a possibility for the birth rate to rise or, at least, to remain constant, but the death rate is bound to decline. If this happens, then birth control will have to go hand-in-hand with the acceleration of the rate of economic growth.

India's rapidly growing population is the most serious obstacle to her economic development. It is not possible to reduce the existing size of population. But it is, of course, possible to slowdown the rate at which population is increasing.

The overall development of the country and rise in per capita income can go a long way in reducing the rate of increase in population. But the birth rate will have to be reduced at the same time. The Government is using both the methods at present. However, India is a large country and most people who live in backward areas are illiterate and ignorant. Naturally, it will take time to make the Governments effort bear fruit.

In short, the wide variations in growth rate, literacy level and sex ratio would have to be taken into account in formulating new strategies to stabilizing India's population in the next for decades.

9.3.2 POPULATION POLICIES IN INDIA

The sizes of the population, its structure, composition and growth rate as well as the migration pattern are closely influenced by the population policies. These policies range from encouragement of high fertility to varying degree of discouragement.

Concept of a population policy: The size of the population, its characteristics, spatial and rural-urban distribution, rate of growth and its determinants decide the quantum, pattern and

distribution of consumption and production. It is, therefore, only natural for the state or the government to be concerned about population. Such concern is most essential for a complex democratic society seeking to eradicate poverty and ensure adequate standards of living for its people. Of course, even an authoritarian leader must consider the actual or potential supply of workers (including army personnel), the requisite equipment and the consumption needs of people. Therefore, the three determinants of population change – birth rate, death rate and migration to or from a territorial unit – have naturally received explicit or implicit attention from rulers or governments since the days of Kautilya.

A policy is defined as a statement of important goals, accompanied by a specified set of means to achieve them. A well-elaborated set of means constitutes a programme. A good policy has to be based on a sound theory linking the means with the ends, although on social issues it is often likely to involve an element of judgement about the connection between inputs and outcomes or the process.

Population Policy represents a strategy for achieving a particular pattern of population change. It would address itself both to the situations arising out of declining population as well as of fast rising population. This policy belongs to the category of policies of "Social Engineering" and for a less developed economy. It is a policy that refers to the governmental measures with reference to population change. Measures and programmes designed to contribute to the achievement of economic, social, demographic, political and other collective goals, through affecting critical demographic variables, namely, the size and growth of population, its geographic distribution (national and international) and its demographic characteristics. The important objectives of population policy are: primarily to reduce fertility and mortality and secondarily to manage redistribution of population. Since mortality is an undeprivable characteristic of population, population policy aims at reduction of mortality through the concept of public health and the mass eradication of epidemics. It seeks to adjust population to the requirements of the economy and optimum spatial distribution of population.

The modern Family Planning includes: (1) the proper spacing and limitation of births (2) advice on sterility (3) education for parenthood (4) sex education (5) screening for pathological conditions related to the reproductive system(6) genetic counseling (7) premarital consultation and examination (8) carrying out pregnancy tests (9) marriage counseling (10) the preparation of couples for the arrival of their first child (11) providing services for unmarried mothers (12) teaching home economics and nutrition and (13) providing adoption services. But the activities vary from country to country according to national family planning policies and objectives.

Population policy aims at Planned Parenthood or non-parenthood. It should aim at reducing the population growth rate and at ensuring adequate replacement. A population policy can be nothing less than a social policy at large. It must work itself into the whole rubric of social life and inter-persuade and be inter-persuaded by all other measures of social change.

In India, the first reference to family planning matters can be traced back to 1916 when P.K. Wattal advocated family planning movement in his book, 'The Population Problem in India'

and the first birth control centre in Bombay was opened by R.D. Kame in 1925. Yet, the British were reluctant in forming a population policy due to non-interference in local matters and controversy between the church and the parliament in Britain over birth control. Even though, Gandhiji advocated self-control instead of other birth control measures however a small group of elite made suggestions to government to propagate information on birth control and its practice. India is having the distinction of being the first country to have an official Family Planning Programme, which was initiated in 1952. During the third five year plan (1961-66), family planning was declared as "the verycentre of planned development". The amendment of the constitution in 1976 has made "population Control and Family Planning" a concurrent subject.

China brought down the growth rate of population from 2.2% per annum during 1960's to 1.0 % per annum during 1990's by offering incentives such as increase in salary by 12.5 Per cent, priority in housing, preference in jobs, heavy taxation to the refusal of one-child norm etc.

The Health Survey and Development Committee were appointed with Sri Joseph Bhore as Chairman in 1943. It came up with several suggestions like (a) contraceptives be manufactured and distributed with the help of the government (b) marriage age be has to be increased (c) knowledge, attitude and practices about family planning are to be improved and (d) person suffering from serious diseases be sterilized. At the time of appointment of Planning Commission, suggestions were made by members of the health programmes social welfare, social sciences panel of the Planning Commission to include Family Planning in the first five year plan. Specific government measures were recommended including provision of facilities for sterilization or giving advice on contraception on medical, social and economic grounds. Research was recommended for the development of inexpensive, safe and efficacious methods of birth control suitable for all classes of people.There was strong elite who agreed with birth control but against the use of contraceptives.There were supporters of another view that if population is well organized, it is a source of power.

Five Year Plans and Population Policy

The first five year plan recognized the population pressure in India which requires a population policy. In the first five year plan, the main appeal for family planning is based on consideration of health and welfare of the family. Public health programme included measures directed to family limitation or spacing of children which is necessary and desirable in order to secure better health for the mother and better care and upbringing of children.The reduction of birth rate to the extent necessary to stabilize the population at a level consistent with the requirement of national economy. During the plan, the Government of India earmarked Rs. 6.5 million for the promotion of family planning. The contraceptive methods advocated during this period were the rhythm, diaphragm, Jelly and foam tablets. The number of family planning clinics increased from 50 in 1951 to 165 in 1953. The family planning objective in the first five year plan was to obtain an accurate picture of the factors contributing to the rapid population increase in India, discover suitable techniques of family planning and advise methods by which knowledge of these techniques can be widely disseminated and make advice on family planning,

an integral part of the services of government hospitals and public health agencies. The plan also recommended the formation of a population policy committee in the Planning Commission and the Family Planning Research and Programme Committee (FPRPRC). The latter was formed on May 6, 1953 under the Chairmanship of C.K. Lakshmanan. The Committee laid emphasis on the maintenance of the health of the mother and welfare of the children a part of the family planning programme and it should be developed as an integral part of the health system. It further recommended for field studies as social attitudes and motivation affecting family planning.

In the second plan need for curbing birth rate was accepted even though the rate of population growth was recognized as an important factor in planning and development. The second plan reiterated the earlier policy to slow down the rate of population growth. An effective curb on population growth is an important condition for rapid improvement in income and levels of living. The Plan stated that an effective curb on population growth is an important condition for rapid improvement in income and standard of living. The end of the second plan, the number of clinics increased to 4,185.

The Third five year plan had an objective of stabilising the growth of Population. The third plan stated the objective of stabilising the growth of Population over a reasonable period as the Centre of planned development. The plan associated population with social policies like education of women, opening new employment opportunities for them and raising the age at marriage. The family planning programme should include sex and family life and advice on such other measures as may be necessary to promote the welfare of the family besides advice on birth control. The strategy of the programme has been shifted from the clinic approach to the community oriented Extension Approach. The main components of the extended programme were: (1) Creation of social climate in which the need is felt by individual families and groups of people; (2) Knowledge that a Small family norm is valuable to each individual permeating into every mind; (3) Provision of readily accessible services, generally as part of health services especially health of mothers and children and (4) Adoption of effective methods by all eligible couples.

At the end of Third plan period, the birth rate stood around 41 per thousand. Successful public health and curative measures had brought down the death rate to around 16.

The Fourth plan insisted on family planning programme as an essential and inevitable factor for development. The goal of the plan was to reduce the birth rate to 32 per 1,000 by the end of the fourth plan and to 25 per 1000 by 1981. The plan advocated that even far reaching social and economic programmes will not lead to a better life unless population growth is controlled. Limitation of family is an essential and inescapable ingredient of development'. On the eve of Fourth Plan, five central institutes and 43 family planning training centers were functioning. There were 4840 rural family welfare planning center's, 21,572 rural sub-centers and 1856 urban family welfare planning centers were in operation.

During the Fifth Plan period (1974-19791, the National Population Policy was announced in April 1976 with a target of reduction of birth rate of 25 per thousand, and a population growth rate of 1.4 per cent by 1980. The legal minimum age at marriage from 15 to 18 for females from

18 to 21 for males. Any violation of the law could be treated as a cognizable offense. The plan attributed the poor growth rate of the economy in the previous plan to the excessive growth rate of population. The aims of the plan were to reduce the birth rate to 30 per 1,000 by 1978-79 and to 25 per 1,000 by 1983-84.

The internal emergency was declared in the country in June 1975 and continued up to March 1977. Several target-oriented, time-bound and coercive measures were resorted to during this period. The Central Government permitted the State governments to pass legislation for the compulsory sterilization for couples with a minimum of three living children. The family planning was considered as a multi-faceted problem and the contribution of all other ministries was sought for the implementation of the problem. Several measures were maintained in the policy such as graded monetary compensations based on the number of living children at the time of sterilization. A new record was created with a reported 10 million sterilizations during this period.

The draft of Sixth Five Year Plan stated that a population policy should reflect concern for the individuals as well as the community's dignity, needs and aspirations, and should be such as would deal with overall development issues and not merely population control. The Plan document envisaged the establishment of a unified, standardized, monolithic pattern of health and family planning for the country and urged that it should be varied to meet 197 differing conditions and take regional variations into account. All the plan projections of reduction of poverty and unemployment will go wrong, if success is not achieved in curtailing the growth of population. The Plan emphasized on demographic goals not only in terms of fertility reduction and mortality reduction and distribution of population, but also in terms of employment and standard of living. The targets put forth in the Sixth Plan are: infant mortality rate to 65 for rural and 50 for urban, maternal mortality below 2, death rate 9, birth rate 21, net reproduction rate of I by the year 2000. The plan allotted an outlay of Rs. 17,750 million for the programme. The performance under the programme during the Sixth Plan was 79.2% of Sterilizations, 81.7% of IUD users and 85.4% of C.C. users was achieved and the increase in couple protection rate was by 9.8 points.

The Seventh Plan stressed the necessity of breaking the vicious circle of adverse circumstances resulting in low contraception and high birth rates. A more comprehensive National population policy was adopted in 1986, by the Government. It was promoted on a voluntary basis as a "Movement of the people, by the people, for the people". This policy has given the family planning a broader perspective by giving importance to female literacy rate, enhance child survival through universal immunization and promotion of oral rehydration therapy, anti-poverty programmes, revamping infrastructure, promotion of two-child family norm etc., in addition to usual measures of raising age at marriage for females to 20 years, Maximum involvement was sought on the part of non-governmental institutions. The Seventh Five Year Plan stated a multi-disciplinary approach through voluntary peoplesprogramme and to generate environment for fertility decline through relevant socio-economic intervention. The goals of family welfare were envisaged in the plan. They were to achieve CBR of 29.1 per 1000,

CDR of 10.4 per 1,000, infant mortality of 90 per 1000. live births, effective couple protection rate to be increased to 42 per cent by the year 1990. New infrastructure was created in certain States.

The Eighth Plan envisaged the bringing down of the birth rate in India from 30.5 per thousand to 20 per thousand by the year 2000. It noted that the addition of about 1.8 crore persons annually to the population of the country in the early nineties and if the trend is not halted, it would not be possible to render social and economic justice to the millions of the masses.1t envisaged reorientation of the health programe and its structural framework for the delivery. It was emphasized that the underprivileged themselves become the subjects of the process and merely its objects. Community based systems for a population group of 30,000 was suggested to be planned through the strengthening of the infrastructure facilities. The National Development Council appointed a Committee on population with Shri Karunakaran as Chairman in 1991 which proposed the formulation of a National Population Policy in 1993 to take a long term holistic view of development, population growth and environmental protection and to suggest policies and guidelines for formulation of programs and a monitoring mechanism with short, medium and long term perspective and goals. An expert group on National Population Policy headed by Dr. M.S. Swaminathan appointed in 1993 to prepare a draft of national population policy, It has recommended the formation of a Population and Social Development Commission.

National Population Policy

The National Population Policy which was announced in February 2000 seeks40 initiate several measures to achieve a stable population by 2045. The 'immediate objective' of the NPP 2000 is to address the needs for contraception, health care infrastructure, and health personnel, and to provide integrated service delivery for basic reproductive and child health care. The 'medium term objective' is to bring the TFR to replacement levels by 2010, through vigorous implementation of inter-sectoral operational strategies. The 'long term objective' is to achieve a stable population by 2045, at a level consistent with the requirements of sustainable economic growth, social development, and environmental protection. The policy includes freezing the number of seats in Loksabha at the current level of 543 which is based on the 1971 census till 2026, The medium term objective is to bring the total fertility rates to replacement level by 2010 through vigorous implementation of intersectoral operational strategies, the long term objective is to achieve a stable population by 2045, at a consistent level with the requirements of sustainable growth, social development and environmental protection.

To achieve the objectives the NPP has envisaged the following 14 sociodemographic goals for 2010:

1. Address the unmet needs for basic reproductive and child health services, supplies and infrastructure.
2. Make school education upto the age of 14, free and compulsory and reduce drop outs at primary and secondary school levels to below 20 per cent for both boys and girls.

3. Reduce infant mortality rate to below 30 per 1000 live births.
4. Reduce maternal mortality rate to below 100 per 100,000 live births.
5. Achieve universal immunization of child
6. Promote delayed marriage for girls, not earlier than the age of 18 and preferably after 20 years of age.
7. Achieve 80 per cent industrial deliveries and 100 per cent deliveries by trained persons.
8. Achieve universal access to information/counseling, and services for fertility regulation and contraception with a wide basket of choices.
9. Achieve 100 per cent registration of births, deaths, marriage and pregnancy.
10. Contain the spread of Acquired Immunodeficiency Syndrome (AIDS), and promote greater integration between the management of reproductive tract infections and sexually transmitted infections and the National AIDS Control Organisation.
11. Prevent and control communicable diseases.
12. Integrate Indian Systems of Medicine (ISM) in the provision of reproductive and child health services, and in reaching out to households.
13. Promote vigorously the small family norm to achieve replacement levels of TFR.
14. Bring about convergence in implementation of related social sector programs so that family welfare becomes a people centered Programme.

In order to strengthen the Programmes of National Population Policy and to achieve the above mentioned national socio economic goals for 2020, 12 strategic themes are identified as follows: 1. Decentralized planning and programme implementation, 2. Convergence of service delivery at Village level, 3. Empowering women for improved Health and Nutrition, 4. Child health and survival, 5. meeting the unmet needs for & family welfare and services 6. Reaching out to the underserved population groups such as urban slum dwellers, tribal communities hill areas population, displaced and migrant population; adolescents. 7. Making use of diverse health care providers. 8. Collaboration with private sector and NGOs. 9. Main streaming of Indian systems of medicine and Homeopathy. 10. Promotion of research on contraceptive technology and reproductive and child health, 11. Providing for older persons above 60 years and 12. Information's education and communications.

The population of India in 2001 has almost tripled since 1941. The growth rate of population peaked at 2.24 percent per annum in the decade of the seventies and has been gradually declining thereafter, though in absolute numbers population continues to grow at an alarming rate. The rate of growth has been less than 2 percent per annum in the period 1991-2001. Reasons for a high Population growth : a) The large family size many children in a family b) Lack of awareness among people about the hazards of a large population c) High fertility rate and hot climate which helps increase in fertility d) Early age of marriage, especially of girls. e) Low death rate and high birth rate. f) Lack of proper awareness of contraception and other family Planning measures

Family Welfare Program in India

India, the second most populous country in the world, has no more than 2.5% of global land but is the home of 1/6th of the world's population. The prevailing high maternal, infant, childhood morbidity and mortality, low life expectancy and high fertility and associated high morbidity had been a source of concern for public health professional's right from the pre-independence period. The Bhore Committee Report (1946) which laid the foundation for health service planning in India gave high priority to provision of maternal and child health services and improving their nutritional and health status. It is noteworthy that this report which emphasized the importance of providing integrated preventive, primitive and curative primary health care services preceded the Alma At declaration by over three decades. Under the Constitution of India elimination of poverty, ignorance and ill health are three important goals. In 1951, the infant republic took stock of the existing situation in the country and initiated the first Five Year Development Plan. Living in a resource poor country with high population density, the Planners recognized the census figures of 1951, the potential threat posed by population explosion and theNeed to take steps to avert it. It was recognized that population stabilization is an essential prerequisite for sustainability of development process so that the benefits of economic development result in enhancement of the wellbeing of the people and improvement in quality of life. India became the first country in the world to formulate a National Family Planning Programme in 1952, with the objective of "reducing birth rate to the extent necessary to stabilize the population at a level consistent with requirement of national economy". Thus, the key elements of health care to women and children and provision of contraceptive services have been the focus of India's health services right from the time of India's independence. Successive Five Year Plans have been providing the policy framework and funding for planned development of nationwide health care infrastructure and manpower. The Centrally Sponsored and 100% centrally funded Family Welfare Programme provides additional infrastructure, manpower and drugs, vaccines contraceptives and other consumables needed for improving health status of women and children and to meet all the felt needs for fertility regulation.

FAILURE OF POPULATION CONTROL POLICIES

India is first among the countries which adopted an official family planning programme, as early as 1950. However, fifty years later this has not prevented the population touching the one billion mark. It is obvious that despite good intentions and concerted efforts we have failed in controlling our population. Considering the seriousness of the situation, it is appropriate to introspect and ascertain as to what went wrong. The problem, though very complex, can be discussed under two headings:(i)the available methods for contraception and(ii)the users. It is obvious now that there cannot be an ideal contraceptive, suitable for everybody. A careful choice has to be made among the current available methods, depending on the gender, country, socio-religious and cultural practices. According to available information the most accepted methods are the two terminal methods, vasectomy in the case of the male, and tubectomy in the case of

the female. These are methods of choice for all those who have completed their family size and to use them is a conscious decision made by the couple. The next most commonly used methods are the barrier methods, still popular in spite of a high failure rate. The other methods such as the use of contraceptive pills, intrauterine devices and injectables are used by a relatively small percentage of the population. It is also evident that except for the barrier method and vasectomy there are no methods available for male contraception, in contrast to the variety of methods available and in use for the female. Does this mean that the available methods are not adequate for the requirements and this inadequacy is the reason for uncontrolled population growth? The answer is firmly in the negative. The available methods are more than adequate but what is lacking is the will to use them. This brings in the philosophical question as to what is meant by will and why the will is not there. It is for this reason that it was mentioned earlier that the issue of the user is a complex one. The users are both male and female, and with limited options available to the male, the entire burden of limiting the family is shouldered by the female. However, except for a miniscule percentage of the female population, the majority are passive participants in the process with no decision-making capacity. It is in this context that population control was given a new dimension, namely reproductive health, which to a large extentcentres around thefemale. The concept of reproductive health recognizes the diversity of the special health needs of women before, during, and beyond child bearing age, as well as the needs of men and the quality of life of the people involved.

Who is responsible?

Population, if continues to increase at the same rate, it will destroy the country. Lack of initiative by the government together with sleeping people of India, are responsible for this destructive problem. People are not realizing the problem. One day the result will beroits, fighting over food, water? India will be the largest slums creator. All cities will belike fish markets with people everywhere. Traffic will move like the ants party. Everybody will scream, shout, but nobody will listen.

THE CHALLENGES AHEAD

India's per capita income has doubled over the past 20 years. With population growth slowing now to about 1.6 per cent per annum, a growth rate of the gross domestic product (GDP) of around 9 per cent per annum would be sufficient to quadruple the per capita income by 2020.Opinions on achievable rates of economic growth have a tendency to swing along with the short-term economic performances. Two years ago, the global boom, the IT revolution and the all round optimism led many to believe that in the coming decade, India could mimic the 9-10 per cent growth rates that China achieved over a twenty year period. Such optimism is out of fashion today. But there is ample evidence showing that if we can adopt a longer term perspective that is not blinded by immediate circumstances and fluctuating moods, higher rates of growth should be achievable for India in the coming years. This is not a prediction—it is a potential. The reality will depend on how effectively we seize the opportunity to do so. From a

historical perspective, global rates of development have been increasing for more than a century. The dramatic rise of Japan and the East Asian tigers, and most recently China, are illustrative of this point. An objective assessment reveals that all the major engines of economic growth that have accelerated growth up till now, will be present in greater abundance in the coming years than they had been in the past.

9.4 SUMMARY

Rapid population growth continues to be a matter of concern for the country as it has manifold effects, one of the most important being environment degradation. The outcomes of excessive population are industrialization and urbanization. The study reveals that rapid population growth has led to the over-exploitation of natural resources. The deforestation has led to the shrinking of forest cover, which eventually affects human health. The considerable magnitude of air pollution in the country also pulls up the number of people suffering from respiratory diseases and many a times leading to deaths and serious health hazards. The situation is also similar for water pollution, as both ground water and surface water contamination leads to various water borne diseases. From the various effects of environmental degradation on human beings, discussed in this paper, it appears that if human beings wants to exist on earth, there is now high time to give top priority to control pollution of all types for a healthy living. It can be said that even after fifty years of independence, India is unable to achieve the desirable standards of health for its population as consequences of environment degradation. What is desired is the will of the people as well as the cooperation of the Government to promote family planning methods.

9.5 GLOSSARY

1. Population: A population is the number of living things that live together in the same place. A city's population is the number of people living in that city. These people are called inhabitants or residents.

2. Policy: A policy is a deliberate system of principles to guide decisions and achieve rational outcomes. A policyis a statement of intent, and is implemented as a procedure or protocol. Policies are generally adopted by a governance body within an organization.

3. Over Population: Overpopulation occurs when a species' population exceeds the carrying capacity of its ecological niche. It can result from an increase in births (fertility rate), a decline in the mortality rate, an increase in immigration, or an unsustainable biome and depletion of resources.

4. Optimum Population: Optimum population has been defined as that size of population enabling per capita output of the maximum orders accompanied by the highest possible standards of living under a given set of economic and technological conditions.

5. Under Population: Under population exists when a population is too small, therefore unable to fully utilise the available resource endowments. Under population is also characterised by a situation where the available resources are capable of supporting a much larger population with no reduction in living standards. The situation is found in regions of low technical development such as equatorial Congo, Amazon River basin or the rich Prairie region of North America.

6. Family Welfare System: Child and Family Welfare System comprise of laws and policies, programmes, services, practices and structures designed to promote the well-being of children by ensuring safety and protection from harm; achieving permanency and strengthening families to care for their children

9.6 ANSWER TO CHECK YOUR PROGRESS

1. The main solution to solve the population problem in India is to control the birth rate.
2. According to the transition theory of population, population remains stable by increasing or decreasing the birth rate in the initial stage.
3. India's rapidly increasing population has become the most serious problem in its economic development.
4. Family planning was first adopted in India in 1961-66.
5. The Chairman of the Health Survey and Development Committee was Mr. Joseph Bhore.
6. India's population growth was recognized in the first five year plan itself.
7. In 1953 the number of family planning clinics was 165.
8. The objective of the Third Five Year Plan was to stabilize population growth.
9. In the fourth five-year plan, the birth rate was to be reduced to 32 persons per 1000.
10. Internal emergency was declared in the country in June 1976.

9.7 REFERENCES

1. Dhingra, I.C., Garg, V.K., Economic Development and Planning in India, (15thedn.), 2002, Sultan Chand & Sons, New Delhi

2. Misra, S.K., Puri, V.K., Indian Economy, (25thedn.), 2007, Himalaya PublishingHouse, Mumbai

3. Chandna, R.C. (2000) A Population Geography. Kalyani Press: New Delhi

4. Clarke, J.I. (1972). Population Geography. Oxford: Pergamon Press

5. Peters, G.L. and R.P. Larkin (1979). Population Geography: Problem, Concepts and Prospects. Dubuque, Lowa

6. Hussain, M (2009). Human Geography. Rawat Publication: New Delhi

7. Tiwari, R.C. (2011). Geography of India. Prayag Pustak Bhawan: Allahabad

8. http://indiabudget.nic.in/es2001-02/chapt2002/tab91.pdf

9. http://www.popline.org/docs/1490/190029.html

10. http://www.usaid.gov/in/programareas/environm.html

11. http://indiabudget.nic.in/es2001-02/chapt2002/tab91.pdf

12. http://www.india2020.org.in/category/india2020/report/

13. http://planningcommission.nic.in/reports/wrkpapers/wp_hwpaper.pdf

9.8 TERMINAL QUESTION

(A) Long Questions

1. Describe population problem in India
2. What do you understand by optimum population, elaborate with suitable examples and diagram?
3. Evaluate population policy in India
4. Explain role of Five Years Plan in Population Management in India.
5. Give your views on population Management and policy improvement for India

(B) Short Questions

1. What are the major causes of the population problems in India?
2. How does India's rapidly growing population affect the country's economy and resources?
3. What government policies and initiatives have been implemented to address the population problem in India?
4. What are the potential long-term consequences if the population problem in India is not effectively managed?

5. What are the key population policies and initiatives that the Indian government has implemented to control population growth?
6. How effective have family planning programs, such as the National Family Planning Program, been in India's population policies?
7. What role does education and awareness play in India's population policies, particularly in addressing issues like gender inequality and family planning?
8. How do population policies in India balance the need for controlling population growth with ensuring the well-being and rights of its citizens?

(C) Multiple Choice Questions

1. What is the primary reason for India's high population growth rate?
a) Increased birth rates
b) Decreased immigration
c) Increased death rates
d) Improved healthcare
Answers: a
2. Which state in India has the highest population density?
a) Uttar Pradesh
b) Maharashtra
c) Bihar
d) Kerala
Answers: a
3. The National Population Policy of India emphasizes:
a) Encouraging a higher birth rate
b) Promoting smaller families
c) Restricting healthcare access
d) Limiting educational opportunities
Answers: b
4. What is the legal age for marriage in India for males and females, respectively?
a) 18 and 21
b) 18 and 18

c) 21 and 21

d) 21 and 18

Answers: a

5. Which of the following factors contributes to India's gender imbalance due to son preference?

a) Equal opportunities for girls and boys

b) Gender-neutral family planning policies

c) Traditional dowry practices

d) Strict laws against gender discrimination

Answers: c

6. Which organization is primarily responsible for implementing population policies in India?

a) WHO (World Health Organization)

b) UNICEF (United Nations International Children's Emergency Fund)

c) NITI Aayog

d) Ministry of Finance

Answers: c

7. In which year was the "JansankhyaSthirata Kosh" (National Population Stabilization Fund) established in India?

a) 1947

b) 1981

c) 2000

d) 2010

Answers: c

8. What is the goal of India's National Health Mission in relation to population policies?

a) Reducing the availability of healthcare services

b) Increasing maternal and child mortality

c) Providing accessible and quality healthcare, including family planning

d) Promoting traditional medicine over modern healthcare

Answers: c

BLOCK-3 AGRICULTURE AND INDUSTRIAL SCENARIO

UNIT-10 THE AGRICULTURAL INFRASTRUCTURE DEVELOPMENT

10.1 OBJECTIVES

After having the detailed study of this unit you will be able to:

- Learn the main features of the Indian agriculture
- Known the need and importance of the agricultural infrastructure
- Explain the various components of the agricultural infrastructure
- Known the status of the agricultural infrastructure in India
- Understand the role of the agricultural infrastructure in regional development

10.2 INTRODUCTION

India is an agricultural country. Agriculture is the mainstay of livelihood of the Indian population and has a dominant role in Indian economy. The shares of agriculture in the Gross National Product has declined so much but still agriculture forms the base of the Indian economy, industries and also provide employment to a large size of population. In 1950-51 about 69.5% working population of India was engaged in agriculture and allied activities. According to the economic review of the 2015-16, total shares of the agriculture and allied sectors were 48.9% in total employment. More than 50% population of India still depends directly on the agriculture and allied sectors for their livelihood. Various industries such as cotton textile, sugarcane, edible oil and food processing industries are directly based on agriculture and gain raw material from agricultural sector. Agriculture is the major source of livelihood in India and provides base to various agricultural based industries in the country. Our various festivals find base in the agriculture all over the country from east to west and from north to south. Agriculture still shares a huge percentage in the GDP of India and also in total export of the country and fetch valuable foreign exchange. Agriculture is directly linked with the food security and nutritional requirements of the masses in India. Various factors are essential for healthy and continuous agricultural production so that goals of social security and economic developments can be achieved.

10.3 THE AGRICULTURAL INFRASTRUCTURE DEVELOPMENT

10.3.1 THE AGRICULTURE

India is a country of the great climatic diversity; situated in tropical and temperate zones. These favourable conditions make available more than 55% of its land for agriculture. Most of the countries of the world raise only one crop in the year but India has the privilege to produce two or more crops in different parts of the country. So that huge diversity in crops too are inevitable, one side tropical crops like rice, sugarcane, peanut, banana are easily cultivated in the country and on other side temperate crops like cotton, wheat, soybean, are produced efficiently. Indian agriculture dominated by the production of food crops (64.18% of cropped land) and phenomenal area (about 30% of cropped land) is available for fodder crops, pastures, cash crops and other allied activities. Due to the huge diversity of physical and climatic conditions different crops are grown here in the country can be grouped as:

Food Crops:

India is the country of more than 120 crores of population, thus there is a continuous demand for food crops throughout the country. People generally prefer to grow crops that have in continuous demand and available market. Indian agriculture is mainly of subsistence type and main motive of population is to fulfill the food demands of the family. Thus major part of the agricultural land in India is covered by the food crops. Rice, wheat, maize, pulses like gram, and tur, jowar and bajra are the important crops produced in India. These crops are grown all over the country and throughout the year. Three crops of rice are raised in the states of Assam and West Bengal. Fields remain hardly vacant where there is irrigation facilities are available.

Cash Crops/Commercial Crops:

These are the crops raised for sale in a raw and semi-processed form to generate income by the farmers. These crops include sugarcane, groundnut, soybean, mustard, etc. They provide raw materials to a large number of agro-based industries in India and fetch more income to the farmers as compared to other crops.

Drinkable Items:

Tea, coffee, and tobacco are the main drinkable items produced in different regions of India; mostly in Assam, Kerala, and many others. These are also important cash crops.

Fibers:

Cotton, jute and mesta, etc. are the fibers used as raw material in different agro-based industries are the important commercial crops grown mainly in West Bengal, Gujarat, and Maharashtra states.

Determinants of Agriculture in India:

Agriculture in India is determined by various factors comprising physical, institutional and technological factors etc. Physical factors which determine agriculture in India are topography, climate, soils etc. Institutional factors are size of farms, land tenure system, and technical factors include irrigational facilities, use of HYV seeds, fertilizers, farm machinery, pesticides/insecticides etc. All these have collective impacts on the development of agriculture, crop production and productivity in the country.

MAIN FEATURES OF INDIAN AGRICULTURE:

India is predominantly an agricultural country but conditions of farmers and agriculture both are poor. As compared to world average of only 11 % land available for agriculture, India is in very advantageous conditions as about 55% India's land is available for farming. But due to poor productivity, dominance of food crops, intensive subsistence type of agriculture and poor institutional and technological developments, Indian farmers are not sound much economically. Agriculture in India is not economically viable presently leaving some exceptions of big farmers. Continuous higher rates of population growth are making this situation more complicated. In spite of huge technological advancements in agricultural machinery and technology all over the world, Indian farmers are still dependent on traditional agricultural methods, tools and techniques. Modernization of farming in India is still limited to big and economically sound farmers. In India, agriculture is still of subsistence type and agricultural productivity is very low as compared to the developed countries of the world. Main objectives of Indian farmers' are still to fulfill their family needs; only surplus production is available for marketing. Commercialization of agriculture in India is very limited and restricted to a very few crops. Poor

Indian farmers are not in conditions to use much oriented technology, HYV seeds, and chemical fertilizers. Small size of land holdings and faulty tenure system are proving hazardous to the agriculture in India. Main characteristics of Indian agriculture can be grouped as follows:

1. Ever-increasing pressure of population.
2. Poor productivity of crops.
3. Dependent on monsoon.
4. Unbalanced distribution of land among farmers.
5. Ill defined tenure system.
6. Intensive agriculture.
7. Small size of land holdings.
8. Highly diversified agriculture.
9. Dominance of food crops.
10. Traditional methods of farming.
11. Problematic nature of Indian agriculture.
12. Poor technological advancements as compared to developed countries.
13. Poor crop commercialization.
14. Illiterate and unaware farmers.
15. Poor risk bearing capacity of the farmers.

10.3.2 THE INFRASTRUCTURE DEVELOPMENT

Agriculture is affect by many factors like, natural, institutional and infrastructural, etc. Topography, relief, climate, and soils are the major natural factors decide the agriculture of any area, country or region. Whereas irrigation, seeds, fertilizers, energy and power sources like petrol, diesel, electricity etc. are the major infrastructural factors play an important role in agriculture and crop production. For the growth, development, and healthy agricultural practices and also for desired crop production, agricultural infrastructure is must. Without the availability of desired and up to the mark infrastructure, production of crops suffers a lot. Thus it is important to have a look of the agriculture related infrastructure and their status in India.

Role of agricultural infrastructure in regional development

Region is a differentiated segment of the earth surface having some similarities and can be differentiated from other nearby area easily on the basis of some specific characteristics. Regional development refers to develop an economically and socially backward area with special aids and assistance. Rural infrastructure provide base for extensively improving the quality of life in the rural areas by accelerating the process of agricultural development. Agricultural infrastructure projects, in general, need high financial support, with high risk whereas low rate of returns on investments. Agricultural infrastructure has direct connections with the farmers' access to institutional finance and markets, and increasing crop yields, for instance adequate money helps in promoting agricultural production quantitatively as well as qualitatively. Agricultural infrastructure keeps the potential to renovate and modernize the traditional agriculture practices or subsistence agriculture into modern, profitable and dynamic farming system in India.

Agricultural infrastructure is considered to have wide range of services and aids that facilitate the agricultural production, procurement, and processing of agricultural products, and also conservation and trade of such products. Agricultural infrastructure may be grouped under following categories-

Input based infrastructure: Seeds, fertilizers, pesticides, farm equipments and machinery etc.

Resource based infrastructure: Irrigation facilities and energy sources

Physical infrastructure: Road network, transportation, storage, processing, preservation, etc.

Institutional infrastructure: Financial services and banking, marketing, information, advertisement and communication services, research and development in agriculture (R&D), extension services, awareness and education of farmers etc.

Agriculturists and economists have recognized the growing importance of agricultural infrastructure in overall development of the agriculture in India. They are sure that its role not only limited to agricultural development but also broadened up-to the livelihood, food and nutritional security of the population and future economic developments of the country. In this regard eleven components of infrastructure have been identified which are - irrigational facilities, peoples' access to drinking water, good means of transportation, credit and financial institutions,

efficient storage services for crops, trade and commercial infrastructure, processing units, public services, agricultural research and extension services, communication and information services, land conservation services, health and education services. These are the basic amenities must be available for village development and ultimately the agricultural developments.

India is the country of severe heterogeneity where diversity and disparity in economy, polity, society and culture are at climax. After independence feelings were on high for economic, cultural and social development of the Indian population. During the initial phases of planning, the main emphasis was on overall national development so the approaches and ideas of time bound planning were adopted, formulated and implemented. But after short while, keeping in mind the high diversity of soils, vegetation, relief and socio-economic conditions in the country; concept of regional development gained the momentum which ensures better utilization of highly differential geographical and agro-climatic potentialities across the various regions in India. Each region demands different plan and policy, different agricultural equipment and infrastructure, tools and technology. Efficient regional development heavily resides on availability, accessibility and status of agricultural infrastructure. Regions having efficient agricultural infrastructure are agriculturally developed and economically sound and regions lacking these facilities are lagging behind in the country for instance Punjab, Haryana and western Uttar Pradesh is developed only due to their developed agricultural infrastructure.

Investments like irrigation, fertilizers, energy and seeds are the backbone of the agriculture in India. Future of Indian agriculture, its sustainability and food security of Indian population very much depend on them.

IRRIGATION

Among many other infrastructural factors, irrigation is an important factor for agriculture in India. In fact, irrigation is the base of modern agriculture. Supply of water to the crops, artificially, in absence of rainfall is known as ‘irrigation’. Without adequate irrigation agricultural production suffers much and quality of crops also sacrifices. In Indian scenario where agriculture is very much depends on monsoonal rain, which is very irregular and uncertain and of limited nature; irrigation is more important for proper production of crops. Besides this rainfall in India is unevenly distributed i.e. different regions, states and areas in India receive

different amount of rainfall. All these factors increase the role of irrigation in India. Various crops need different amount of water and crops like rice, sugarcane, Jute and various horticultural crops need much amount of water regularly. Due to the huge importance and need of water Government of India has established Water Irrigation Department, Water Resource Ministry and National Water Policy was decided to facilitate, manage and fix appropriate use of available water resources in the country. Irrigation in India includes a network of major and minor canals from perennial and seasonal rivers, use of groundwater: well and tube well based systems, ponds/tanks, and rainwater harvesting projects for agricultural activities. Among them groundwater based irrigation system is the largest. It is estimated that in 2013-14, only about 47.7% of total agricultural land in India was reliably irrigated. About 2/3rd cultivated land in India is dependent on monsoons. Irrigation in India has helped in sufficient crop production, improved agricultural productivity, and improved food security, less dependence on monsoons, and also created several agriculture based job opportunities. Dams; constructed to support irrigation, produce electricity and water based transport facilities, and also provide drinking water to the growing population, and help in controlling floods and frequent droughts in the country.

Need of Irrigation in India:

Need of irrigation specifically in India rises due to the various factors which are as follows:

1. Uncertainty of rainfall
2. Long monsoonal gap
3. Irregularity of rainfall
4. Limited duration of rainfall
5. Uncertainty of monsoon burst and retreat
6. Torrential nature of rainfall
7. Some specific crops need higher amount of water
8. Commercial crops need more water
9. HYV's need regular irrigation
10. Different nature of soil throughout the country
11. Presence of dry areas and regions in the country

Facilities of Irrigation in India:

Indian climate is tropical monsoonal and country receive most of its rainfall due to monsoonal rainfall. Irrigation is must for proper agricultural practices throughout the country. Geographical and geological conditions are favorable in India for constructing various means of irrigation leaving some parts in the country as;

1. Perennial Rivers
2. Soft sedimentary soils
3. Fertile land
4. Abundance of Plains
5. High underground water table
6. Abundance and suitability of ponds in South India.
7. Continuous need for irrigation due to large number of agro-climatic zones

Above mentioned factors have supported the development of a large irrigation networks in the country, whether it may be canals, wells, tube wells, ponds/tanks or small or giant dams. All collectively and individually support the irrigation and ensure proper crop production.

Means of irrigation in India:

Due to the geological, topographical, and climatic variations, different means of irrigation are in practice in India, which are as follows:

Canals:

Canals are the major source of irrigation in India and about 25% of total irrigated land in India is covered by canal irrigation. It is cheaper as compared to the other irrigation sources. Plane surface is suitable for canal formation. Canals are spread throughout the country but major concentration of canals is seen mostly in the states of Uttar Pradesh, Punjab, and Bihar. Canals are mainly of two types; perennial and seasonal canals. The largest canal in India is Indira Gandhi Canal, which is about 650 km long. The maximum part of the total irrigated area of the country by canals is in Uttar Pradesh followed by Punjab and Haryana. About 165.97 lakh hectare land of India was irrigated by canals during the year 2008-09 from which half of the irrigated land concentrated in the Northern plains of India. Other major states where irrigation is done by the canals are Haryana, Punjab, Madhya Pradesh, Bihar, and Andhra Pradesh. Canal provides irrigation to 91.72 % of irrigated area in Jammu & Kashmir, 64.7 % in Orissa, 66.24 % in Chhattisgarh, 44.28% in Haryana and 34.63 % irrigated area of Andhra Pradesh is irrigated by canals.

Major canals of India which are providing irrigation to a large part of the country are as follows:

Sutlej-Yamuna link Canal: Sutlej Yamuna link canal is about 214 km long freight canal which links Sutlej and Yamuna rivers and canal also known as SYL.

Sirhind Canal: It irrigates the areas of Punjab and Haryana.

Indira Gandhi Canal: It irrigates the districts of Ganganagar, Bikaner, Jodhpur and Jaisalmer in Rajasthan.

Buckingham Canal: It irrigates Andhra Pradesh and Tamil Nadu

Triveni Canal: It irrigates the agricultural lands in Bihar

Upper Ganga Canal: Uttarakhand and Uttar Pradesh

Lower Ganga Canal: Uttarakhand and Uttar Pradesh

Kaveri-Vaigai link Canal: Kerala, Karnataka and Tamil Nadu

Agra Canal: Uttar Pradesh, Haryana and Rajasthan

Sarda Canal: It irrigates the land in Uttar Pradesh.

Eden Canal: It has been taken out from the river Damodar in West Bengal.

Tilpara Dam Canal: It irrigates the areas of West Bengal.

Mutha Canal: It has been taken out from the river Mutha near Khadagwasala (Pune) in Maharashtra.

Sampad Sagar Canal: It irrigates the areas of Andhra Pradesh.

Wells:

Wells for irrigation are in use from ancient time throughout the India but major concentration of wells can be easily noticed in northern India mainly from Punjab to Bihar. Besides this wells are also used in eastern Rajasthan, Gujarat, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, and Madhya Pradesh. Wells are the cheap means of irrigation for poor Indian farmers. In 1950-51 about 50 lakh wells were in the country and presently their numbers goes more than 150 lakhs.

Tube wells:

Use of tube wells started in India only after the year 1930 and used mainly in those areas where there is canal formation is not possible. But in more recent tube wells are frequently in use most of the Indian states; were there is underground water is available in abundance. Wells and tube wells collectively support 58% irrigated land of the country.

Merits of well and tube wells are in abundance but demerits are also huge. Limited access as limited area can be irrigated, wells get dry easily, higher investment of money and labour, decreasing water table, well and tube wells are not beneficial in areas with saline underground water are some demerits of well and tube well irrigation in India.

Ponds:

Ponds are the lower places on the earth surface where rain water collected. Ponds may be either natural or artificial. Southern India keeps important place in pond irrigation and a huge land is irrigated by ponds in states like Tamil Nadu, Karnataka, Orissa, Jharkhand, Uttar Pradesh and Rajasthan etc. About 3.4% irrigation is done by ponds in India. Positive aspects of pond irrigation are as most of the ponds in India are natural so no need of investment to construct, artificial ponds are also not costly to dig, fisheries can be done in ponds. On the other side they generally get dry in hot summers, huge sedimentation due to rain every year and limited irrigation is negative aspects of ponds.

Dams:

Dams are the larger from of ponds; constructed manually and rain or river water stored in them which is used for irrigation, drinking and also for electricity generation. Bhakara Nangal, Heerakund, Tehri, and Rihand are the important dams of India.

POWER

Power resources are the base of industrial as well as agricultural development of any country. With the modernization of agriculture and increasing use of modern energy driven tools in agriculture, importance of power sources in agriculture is increasing day by day. In modern age of industrialization and mechanization, status and scope of power resources are the indicators of economic development of any country. Countries are considered powerful and developed

because of their power resources and their developmental status. There are mainly two type of power resources are available are as under:

Renewable Energy resources: are those which can be used again and again. For example water energy, wind energy, tidal energy and vegetation, etc. are the renewable energy sources. Most of them are non conventional sources of energy in India.

Non-renewable energy resources: are those which can be used only once i.e. they exhaust after single use. Coal, petroleum, and natural gas are the non-renewable energy sources. These all are conventional sources of energy and their use is very common.

With the development of irrigational facilities, use of HYV's seeds, and frequent use of fertilizers; mechanization of agricultural activities is at large scale in India. Animal and human labour replaced by the tractors, threshers, harvesters, energy driven tube wells, etc. All these need a large amount of power for operation. Power sources are frequently in use in running machinery in agriculture. Machines like tractors and pumping sets run by petroleum, while tube wells, run by electricity. Diesel is more costly product for poor farmers as compared to electricity. Cheap and regular electricity is important in decreasing input cost by the farmers. There are huge crises of electricity supply. Demand is higher and production and supply are lower. In the year 1950-51 only 3.9% electricity was used for agricultural activities, which increased to 21.7% in 2006-07. There is huge demand of electricity in agricultural activities; and agricultural growth may suffer negatively in the absence of proper supply of electricity in agriculture sector. Rural Electrification Corporation was established in 1969 to facilitate electricity in the rural areas of the country. Subsidies are common in rural villages. States like Haryana and Punjab are using more than 40% of their electricity for agricultural purposes and the use of electricity is increasing continuously in the other Indian states such as Uttar Pradesh, Bihar, Gujarat, Karnataka, Tamil Nadu, and Rajasthan etc.

FERTILIZERS

With the irrigation and improved seeds, fertilizers also beneficial in producing crops in ample amount and is an important investment in agriculture. Appropriate uses of fertilizers facilitate positive growth in crop production. Nitrogen, Phosphorus, and Potash are the main

three fertilizers used in agriculture, besides various micro-nutrients. Tremendous growth has been seen in the production, import and use of fertilizers after Green Revolution in India. Country is just after USA and China in use and production of fertilizers in the world. The use of fertilizers in India was very limited before Green Revolution but after it, the use of chemical fertilizers increased in leaps and bonds. It the increased to 24909 thousand ton in 2008-09 from only 16788 thousand ton in the year 1960-61.

Per hectare use of fertilizers has increased many folds after Green Revolution but it is very less as compared to other developed countries of the world. In the year 2008-09 per hectare use of fertilizers were 129.2 kg. There are ample scope for increasing fertilizers use and also crop production in India. Huge variations are obvious in the use of fertilizers in India, states like Punjab, Haryana, Uttar Pradesh, Andhra Pradesh and Tamil Nadu are using fertilizers in huge amount per hectare whereas states as Arunachal Pradesh, Sikkim, Uttarakhand, Mizoram and Nagaland are using very low amount of chemical fertilizers per hectare. Use of fertilizers like Nitrogen, Phosphorus and Potash should do in the ratio of 4:2:1 for most crops but huge variation is seen in use due to lack of awareness of the farmers resulting in poor crop production and various soil related problems.

SEEDS

Seeds are the major part in agriculture throughout the world as seeds decide the ultimate quality and quantity of agricultural production. In this sense role of High Yielding variety (HYV) seeds are more important and essential asset and investment in agriculture. Use of improved varieties of seeds in different agro-climatic regions of India can support increased production.

First and foremost a HYV seeds of wheat was developed in Mexico and further Indian scientists developed improved varieties of wheat from Mexican wheat Lerma Rajo, Sonora-63 and 64 and Kalayan Sona are suitable in Indian agro-climatic conditions. These improved seeds were the torch bearer of Green Revolution in India. Improved variety of rice IR-8 developed by the International Rice Research Institute, Philippines in the decade of 1960. IR-8 rice seeds were found suitable for geographical conditions of India. After that HYV seeds of sugarcane, pulses, cotton, and various other crops were developed and successfully diffused in India.

For this purpose, Indian seed development programmes were adopted and various institutes were established at the state and national level to support the programme. Contributions of Indian Council of Agricultural Research (ICAR), various private, government and co-operatives are valuable. Universities like Chandra Shekhar Azad Agricultural University, Kanpur, G.B. Pant Agriculture University, Pant Nagar, Faizabad Agriculture University, and many more are continuously working towards modified seed production. National Seeds Corporation (NSC) established in 1963, State Farms Corporation (SFC), State Seed Corporation (SSC) and more than 100 privately owned companies are continuously working in the field of seed improvement, up-gradation and modifications. Besides these, various state seed certification agencies, research laboratories are also working for seed certification and related research. In the years 2008-09 about 19000 thousand quintal certified seeds were distributed to the farmers, the amount of certified seeds distributed were only 5750 thousand quintal in the year 1991-92, thus amount of certified seeds are increasing continuously.

Characteristics of Improved/Hybrid Seeds:

1. Suitable for the use of fertilizers.
2. Short maturation period of crops.
3. Adequate utilization of irrigation.
4. Employment Generation.
5. Ease of use.
6. Better yield.
7. Greater uniformity.
8. Improved color and quality.
9. Disease resistance.
10. Higher income.

But various problems are also linked with the improved varieties of seeds. Lower water table, higher use of fertilizers and pesticides, required better infrastructure, financial crises, poor mechanization, and lacked extension services, markets and storage, health issues, poor by-products and various environmental problems are linked with HYV's of seeds in India. Main deficiencies of HYV's seeds programme are as:

1. Seeds not tested and certified scientifically due to lack of developed seed testing mechanism in India. So that a huge amount of uncertified seeds are being sell in the market every year causing poor production.
2. Ignorance of crops like pulses and oilseeds as main emphasis of these programmes is on wheat and rice seeds.
3. Genetically modified seeds are not environmentally viable and their various health impacts are not tested yet.
4. Autonomy of big companies is prevalent and these seeds are much costly and inaccessible to poor and marginal Indian farmers.
5. Diversity of crops is also at risk.
6. Risk of Bio-piracy.

Problems linked with Indian agriculture:

From the above, it is obvious that there are huge agricultural developments have been taken place in India after independence. Transformations are at all fronts. Huge areal extension of agricultural land, production and productivity increase of agricultural crops, institutional and technical developments are in abundance but still Indian farmers are poor, their living standards are below the desired levels of dignity. The population is leaving agriculture, land reforms are insufficient, land lordships and tenancy problems are still prevalent, actual agricultural workers, in most of the cases, are not the land holders, fragmentation in at apex, size of holdings are reducing every day, poor infrastructure; poor and inadequate irrigation, and transportation facilities are still hindrances in agricultural progress, lower interests of government towards development of agriculture, lower rate of crop commercialization, subsistence and intensive agriculture, traditional and irrational means of agriculture, less focus on allied sectors of agriculture, poor storage and processing of agricultural products, lower capital investment by the government, poor and uneconomic farmers, higher crop diversification, lower productivity, dependency of agriculture on monsoon is still in 21st century, are the major problems of Indian agriculture. We can say that presently agriculture in India is not a passion but a compulsion.

Steps to check the agricultural problems:

India is a developing country and agriculture is still mainstay of employment of population in India. Various problems are linked with the Indian agriculture discussed above. To minimize and solve these problems, prevalent in Indian agriculture, following steps should be taken:

1. Facilitation of adequate and efficient irrigational facilities.
2. Provision of cheap and proper electricity supply and petroleum availability.
3. Cheap and accessible HYV seeds to the poor farmers.
4. Proper and desired supply of fertilizers.
5. Development of transportation network, storage facilities.
6. Proper trade and commerce facilities.
7. Consolidation of landholdings.
8. Adequate and easy capital.
9. Crop commercialization.
10. Viable price fixation of produce.
11. Ceiling of land.
12. Removal of intermediaries.
13. Awareness among farmers.
14. Administrative and political support.
15. Provision of subsidies. and
16. Farm mechanization etc.

Economic Survey indicates that the government is keen interested on doubling the farmers' income and launched several new initiatives that encompass activities from seed to marketing. Soil Health Card, Input Management, Per Drop More Crop in Pradhan Mantri Krishi Sinchai Yojana (PMKSY), Pradhan Mantri Fasal Bima Yojana (PMFBY), online trading platform for agricultural commodities in India (e-NAM) etc, are the good initiations of Government in this regard.

10.4 SUMMARY

Agriculture is the mainstay of a large size of population still after more than 60 years of independence and Indian population still seek shelter of agriculture for livelihood. Agriculture still shares a large part of Indian economy and in spite of a huge diversification of other

economic sectors. In 1950-51 about 69.5% working population of India was engaged in agriculture and allied activities. According to the economic review of 2015-16, total share of agriculture and allied sectors were 48.9% in total employment. More than 50% population of India still depends directly on agriculture and allied sectors for their livelihood. Various industries are directly based on the agriculture and gain raw material from agricultural sector and provides base to various agricultural based industries in the country.

Agriculture still shares a huge percentage in GDP of India and also in total export of the country and fetch valuable foreign exchange and is directly linked with the food security and nutritional requirements of the Indian population. Due to the great climatic diversity and situated in tropical and temperate zones, huge diversity in crops are inevitable crops like rice, sugarcane, peanut, banana, cotton, wheat, soybean, mango are produced here efficiently. Huge infrastructural developments like irrigation, infrastructure, fertilizers, modernization of tool and technique, innovations and diffusions are at large but tut agriculture in India is facing lots of problems too. Small size of land holdings, fragmented farms, ill defined ownerships and tenancy, poor irrigational facilities, heavy dependency on monsoon, not up to date farm machinery, unawareness of farmers, decreasing interests of younger generation in agriculture are the real problems of them, the Indian agriculture is coping off.

After independence Indian agriculture has seen tremendous transformations. But in spite of huge technological developments agriculture in India is still not a case of benefits as most of the farmers in the country are of small types. Infrastructural facilities are not developed fully and reach is very limited. Indian farmers in large are staying on the mercy of monsoon.

Irrigation system is not in very good condition as most of the cases canals remain devoid off from water leaving few months of the year, power and energy supply is not adequate and timely, farmers mainly dependent on diesel for power which is too much costly for poor farmers as prices are increasing regularly, HYV's of seeds and use of modern tools and technology is limited only to some large farmers, financial crises are prevalent among farmers, unbalanced use of chemical fertilizers making land of farmers barren, uncontrolled irrigation causing siltation and water logging problems in the fertile fields. Thus there is a huge demand, adequate and efficient credit, infrastructural and market facilities so that production of crops can be increased and income of the farmers can be raised. Awareness of farmers and extension services can help a lot in this regard and can make agriculture a profitable venture in India.

10.5 GLOSSARY

GDP- Gross Domestic Product

Cash Crops- crops which are grown for sale to return a profit

HYV seeds- High Yielding variety seeds

Regional development- it is a broad term includes the provision of aid and assistance to the regions for their economic development.

Input- What is put in or taken in the process of agricultural production

Irrigation- providing water artificially to the crops

Perennial Rivers- stream flow all around the year

Seasonal Rivers- stream flow for few months mainly in rainy season

Agro-Climatic Zones- a land unit climatically suitable for a certain range of crops with its unique climate and crop growing period

Renewable- source of energy that is not depleted by use

Non-renewable- source of energy that is depleted by use

Mechanization- process of moving from work by hand/animals to the work with machinery

Fertilizers- substance added to soil to increase its fertility

Bio-piracy- unlawful commercial exploitation of biological materials

Crop commercialization- production of crops for sale in the market, rather than for family consumption

NAM- National Agriculture Market

10.6 ANSWER TO CHECK YOUR PROGRESS

1. India's climate is of diverse type.
2. India has the largest farmer population in the world.
3. India's agriculture is mainly of discharge type.
4. Tea Coffee Tobacco is the included main beverage crop.
5. Cash crops include sugarcane, groundnut, mustard and soybean.
6. Agricultural factors in India are determined by the climate here.
7. About 55% of India's agricultural land is cultivable.
8. Indian farmers still do farming using traditional methods.
9. To increase agricultural crop production, Indian farmers have been adopting since the 1960.
10. Irrigation is required in India due to irregular weather conditions.

10.7 REFERENCES

1. Chauhan, Dharmendra Singh (2010): "Agricultural Geography", Ritu Publications Jaipur, India.

2. Gautam, Alka (2012): "Agricultural Geography", Sharda Pustak Bhavan Allahabad.

3. Husain, Majid (1996): "Systematic Agricultural Geography", Reprinted 2007, Rawat Publication, Jaipur and New Delhi.

4. Mamoria, Chaturbhuj. (1992): "Adhunik Bharat ka Brihat Bhoogol", Sahitya Bhavan, Agra.

5. Ojha, S.S. "Bharat ka Bhoogol". (2005): Bhaugolik Adhyan Sansthan, Govindpur, Allahabad.

6. Singh, J. and Dhillon, S.S. (2nd ed.). (2000): "Agricultural Geography", Tata McGraw Hill, New Delhi.

7. Tiwari, R.C. (2004): "Geography of India", Prayag Pustak Bhawan, Allahabad.

8. Agriculture Survey of India, 2017-18.

9. Economic Survey of India (vol.1st and 2nd). Oxford University Press, New Delhi.

10. Indian Budget, 2017-18.

11. Industrial Survey of India, 2107-18.

12. Khan, A. S. (1968): "Technological Change and Their Diffusion in Agriculture, Problem of Agriculture development in India", Edited by Dr. S. S. Jain, Kitab Mahal, Allahabad.

13. Khan, A. S. (1968): "Technological Change and Their Diffusion in Agriculture, Problem of Agriculture development in India", Edited by Dr. S. S. Jain, Kitab Mahal, Allahabad.

14. Lekhi, R. K. and Singh, Jogindar (2012): "Agricultural Economics", Kalyani Publishers, Ludhiana, New Delhi

15. Sharma, T. C. (1999): "Technological change In Indian Agriculture, A Regional Perspective", Rawat Publications, Jaipur and New Delhi

16. Singh, J. and Dhillon, S.S. (2nd ed.). (2000): "Agricultural Geography", Tata McGraw Hill, New Delhi.

17. Singh, Jasbir and Dhillon, S. S. (1984): "Agricultural Geography", Tata Mc Graw Hill publishing company Limited,

18. Singh, L.R. (ed.). (1987): "India: A Regional Geography", New Printindia Pvt. Ltd., Ghaziabad, U.P.

19. Symons, L. (1968): "Agriculture Geography". G. Bell and Sons Ltd. London.

20. Taylor, James A. (1968 ed.): "Weather and Agriculture", Oxford: Pergamon.

21. Young, Arthor. (1770): "Environment and Cropping Patterns in England".

10.8 TERMINAL QUESTIONS

(A) Long Questions

1. Define role of agriculture in Indian economy with its salient features?

2. What do you mean by agricultural infrastructure? Explain role of agricultural infrastructure in regional development?

3. Discuss the agricultural infrastructure and explain irrigation and its various methods in Indian context?

4. Explain the role of power, fertilizers and HYV seeds in agricultural development of India?

(B) Short Questions

1. What is the significance of agricultural infrastructure development in India?

2. What are some key components of agricultural infrastructure in India?

3. How does the development of cold storage facilities impact India's agricultural sector?

4. What role does transportation infrastructure play in connecting rural farmers to markets in India?

5. How has technology been integrated into agricultural infrastructure development in recent years?

6. What challenges and obstacles does India face in enhancing agricultural infrastructure?

7. What potential benefits can be realized by improving agricultural infrastructure for Indian farmers and the overall economy?

8. Why is irrigation important for agriculture in India?

9. What are the major sources of irrigation in India?

10. What are some of the challenges and issues related to irrigation in India?

11. What is the significance of the Indira Gandhi Canal, and in which Indian state is it located?

12. Name the canal system that originates from the Sutlej River and plays a vital role in providing irrigation to northwestern states like Rajasthan and Haryana.

(C) Multiple Choice Questions

1. What percentage of India's population is employed in the agricultural sector?

a) 25%

b) 50%

c) 75%

d) 90%

Answers: c

2. Which of the following states in India is known as the "Rice Bowl of India"?

a) Punjab

b) Kerala

c) West Bengal

d) Rajasthan

Answers: c

3. Which crop is commonly referred to as the "Golden Fiber" in India?

a) Wheat

b) Cotton

c) Sugarcane

d) Pulses

Answers: b

4. What is the main source of irrigation in India?

a) Canals

b) Tube wells

c) Rainwater

d) Lakes and rivers

Answers: a

5. The Green Revolution in India primarily focused on increasing the production of which crop?

a) Rice

b) Wheat

c) Cotton

d) Sugarcane

Answers: b

6. Which agricultural practice is commonly followed in the arid and semi-arid regions of India to conserve soil moisture?

a) Organic farming

b) Crop rotation

c) Drip irrigation

d) Dryland farming

Answers: d

7. Which Indian state is known for its production of saffron, mainly grown in the region of Pampore?

a) Punjab

b) Jammu and Kashmir

c) Haryana

d) Himachal Pradesh

Answers: b

8. In India, the Kharif season refers to the:

a) Summer crop season

b) Winter crop season

c) Monsoon crop season

d) Rabi crop season

Answers: c

9. Which state in India is the largest producer of horticultural crops, including fruits and vegetables?

a) Maharashtra

b) Uttar Pradesh

c) Andhra Pradesh

d) Tamil Nadu

Answers: a

10. What is the main objective of the National Mission for Sustainable Agriculture (NMSA) in India?

a) Promoting organic farming

b) Enhancing farm mechanization

c) Increasing agricultural productivity and ensuring the sustainability of agriculture

d) Expanding agricultural credit facilities

Answers: c

1. How much percentage of population of India was engaged in agriculture during 1950-51?

2. Name four food crops of India?

3. How much percentage of cropped area in India is covered by food crops?

4. Sugarcane is which type of crop?

a) Food crop b) Cash crop

5. Give examples of drinkable crops?

6. Name important factors determining agriculture in India?

7. What are HYV seeds?

8. How much percentage of India's land is available for farming?

9. Give examples of input based infrastructure in agriculture?

10. What irrigation means?

11. Indian agriculture is much depends on monsoonal rain-

a) True b) False

12. Where Buckingham canal is used for irrigation?

13. Give examples of non-renewable energy resources?

14. What is the appropriate ratio of NPK for crops?

15. Where HYV of wheat was developed firstly in the world?

16. Which rice seed was found suitable in Indian geographical conditions?

Answers:

1. 69.5%

2. 64.18%

3. Wheat, Rice, Maize, Gram

4. b) Cash crop

5. Tea, Coffee, Tobacco

6. Physical, Institutional and technological factors

7. Provide more production per hectare as compared to other seeds HYV- High Yielding variety seeds

8. 55%

9. Seeds, fertilizers, pesticides etc.

10. to supply water artificially to the crops

11. a) True

12. Andhra Pradesh and Tamil Nadu

13. Petroleum, Coal etc.

14. 4:2:1

15. Mexico

16. IR-8

UNIT-11 INSTITUTIONAL FACTORS

11.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Know the meaning of the institutional factors
- Understand the major components of the institutional factors
- Known how they are linked with the agricultural developments of India
- Link the role and significance of institutional factors in Indian agricultural development
- Understand the problems related with institutional factors and agricultural reforms
- Measures the reform and transform these factors to overall agricultural development

11.2 INTRODUCTION

You have understood that agriculture in India is influenced and determined by various physical, institutional and technological factors. Physical factors like topography, climate, and soils are important. Besides these institutional factors mainly refer to as land holding size, land tenure system, and land reforms are also greater determinants of agriculture and crop production in India. Various technological factors you have studied earlier like irrigation, use of high yielding variety seeds, chemical fertilizers, pesticides, and agricultural machinery collectively and separately have impacts on the agriculture and decide the crop production and productivity in India.

11.3 INSTITUTIONAL FACTORS

Besides physical factors, institutional factors are important determinant of agriculture. Growth and development of agriculture and agricultural production; quality and quantity of crops very much decided by these factors of land holding size, practiced traditions, land reforms and prevalent land tenure systems. Countries like India, where huge socio-economic imbalances are prevalent, and these factors play important role in agricultural development. Present agricultural status of India is the result of institutional factors prevalent as all these fix the field size, cropping pattern, crop types, land use, and crop productivity. Brief reviews of these institutional factors and their impacts as under:

1 LAND HOLDING PATTERN

The term 'agricultural holding' designate average size of agricultural land held by the farmers in India. An operational land holding in India is a unit of land used wholly or partly for agricultural production and operated by one person alone or with the support of others members. An operational land holding may have of either only one or more packages of land. Operational land holdings include only those units which are used either in crop production or collectively for crop production with livestock and poultry products or other allied agricultural activities.

There are five kinds of land holdings in India, depending on various sizes, for instance, marginal holdings, small holdings, semi-medium, medium holdings, and large holdings; maximum number of operational land holdings in India is marginal holdings. The concept of agricultural operational holdings does not include those land holdings which are not operating any agricultural land and are engaged completely in livestock, poultry and fishing or others etc. On the basis of operated area, operational holdings by Agriculture Census are categorized as follows:

Table 11.1: Categorization of Size of Holdings.

Sl. No.	**Category**	**Operated Area**
1.	Marginal holdings	< 1.00 hectare
2.	Small holdings	1.00 – 2.00 hectares
3.	Semi-Medium holdings	2.00 – 4.00 hectares
4.	Medium holdings	4.00 – 10.00 hectares
5.	Large holdings	10.00 hectares and above

There are two concepts prevalent in India regarding land holdings; one is operational land holding and another one is ownership holding. Operational holding is the land, which is used for or under the agricultural activities; partially or fully. While ownership holding is the result of fragmentation of land holding with the time and not necessarily under agricultural use. In India land holding size is very small thus land is not much economically viable. Main cause of small land holding size is the continuously growing population of the country and faulty system of inheritance; making land holding size small to smaller with every generation. As in India father's land is divided into his sons (ownership by inheritance) results in decreased size of land holdings. Fragmentation of land is also the result of land inheritance system prevalent in India.

With the time size of land holdings decreased and number of holdings increased. In the year 1970-71 numbers of land holdings in India were about 71 million which increased to 115.6 million in 1995-96 i.e. number of land holdings increased by 62% while operational land holding increased only 1.1% i.e. from 162 million hectare to 163.48 million hectare in the same time span. According to one estimate per capita availability of agricultural land decreased from 0.29 hectare of 1971 to 0.13 hectare in 1991. The average size of land holdings also decreased from 2.28 hectare of 1970-71 to 1.41 hectare in 1995-96. All these are uneconomical for carrying agricultural operations beneficially. Owners of such a small size of land holdings with great fragmentation are not much sound economically and cannot bear the higher coasts of irrigation, fertilizers, pesticides, high yielding variety seeds (HYV's seeds), and new farm machinery. Thus crop production and productivity suffer a lot.

For the planning purpose and accomplishment of land reforms, complete information about the characteristics of different size classes of land holdings is essential. This is also necessary to identify and devise programmes and policies for the benefits of small and marginal farmers especially, the rural poor and economically weaker sections of the society. The information is required by operational holdings as distinct from ownership holdings. An operational holding is defined as 'all land, which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone or with others without regard to title, legal form, size or location'. Thus, the Agricultural Census of operational holdings assumes importance as a source of basic data required for several uses. Out of the total number of 97.8 million holding in 1985-86, 58.1 per cent was of marginal category, and the remaining were the categories of holding include small category (18.3 per cent), semi-medium (13.6 per cent), medium (8.1 per cent) and large (2.0 per cent).

According to the Census data of 2010-11, about 67 percent of India's agricultural land is detained by the marginal farmers having land holding size below one hectare and 18 per cent were classified as small (one-two hectare). Whereas, it is estimated that only 0.7% percent agricultural land is under large holdings of 10 hectares and above. The average size of the holding has been estimated as 1.15 hectares. The average size of land holdings is showing a sturdy declining trend over various Agriculture Censuses since 1970-71. This evidently shows the strain that marginal farmers experience in India.

As per the Agriculture Census 2010-11, total number of operational holdings was estimated to as 138.35 million. The total operated area was 159.59 million hectares. The number of agricultural operational holdings in the country has seen a steady increase over the years. From 115.58 million operational holdings in 1995-96, this number has increased to 138.35 million operational holdings in 2010-11, an increase of 20% over 16 years. The total operated area has seen mixed trend. It reduced from 163.35 million hectares in 1995-96 to 158.32 million hectares in 2005-06. In 2010-11, it increased to 159.59 million hectares. The average size of land holding has been continuously decreasing on account of increasing number of land holdings from an average of 1.41 hectares in 1995-96. It went down to 1.15 hectares in 2010-11, a decrease of percent.

The percentage of marginal holdings has gone up from 62.9% in 2000-01 to 67.1% in 2010-11. Except the percentage of marginal holdings, the percentage of all other holdings has gone down marginally from 2000-01 to 2010-11. The percentage of large holdings has gone down from 1% in 2000-01 to 0.7% in 2010-11. The percentage of medium holdings went down from 5.3% in 2000-01 to 4.3% in 2010-11.

Following the trends of percentage of land holdings, the percentage of area operated increased for marginal holdings and decreased for all other categories except small holdings. Surprisingly, though the percentage of small land holdings has gone down from 18.9% in 2000-01 to 17.9% in 2010-11, the percentage area under small land holdings increased from 20.2% in 2000-01 to 22.08% in 2010-11. This could be probably because of the increase in total area under operation. The percentage area under marginal land holdings increased from 18.7% in 2000-01 to 22.5% in 2010-11. While the number of medium and large land holdings account for less than 5%, they make up for close to 1/3rd of the total area under operation. Though the number of marginal & small holdings account for 85% of the total number of holdings, they together account for only 45% of the total area under operation.

2 TENURE SYSTEMS

Land tenure specifically refers to the system in which land is held by an individual from the Government. It shows the relationships between the land holder and the State and supreme possession of land rests with the Government. Government gives proprietary rights to the

individuals or communities. Thus, a land owner is in that sense is only a proprietor of that land and he has to pay land revenue for that. Land is held all over the world under different tenure situations. Holding of land depends on different reasons. Ownership or exclusive control by an individual is not the only concept under which land is held and used. If we look from Indian point of view, ownership of land is a western idea. In our country, ownership of land, before the Permanent Land Settlement, always rested with the community. However, in western world, individual ownership of land was recognized both by the state and the community.

In ancient times, the state claimed a share of the produce of the land from the farmer. The laws of *Manu* mentioned one sixth as the legal share of the King of the gross crop produce but during the war and various other emergencies, it was increased to one fourth. It was *Timur* who represented the first systematic attempt in the direction of converting the State's share of the crop produce into money. *Sher-shah Suri* made some improvement in his short reign. The most famous arrangement of land revenue was made under Akbar by his Finance Minister, *Todarmal*; in that time fixation of land revenue; systematic and complete investigation was made to assess the taxable capacity of different lands. Then agricultural land was carefully measured and divided into four classes representing different grades of fertility.

Maratha rulers continued the same system and fixed `Kamal' or the maximum rates for the best lands. The assessment was not permanent in majority of the cases. Later 'revenue farmer' came into existence who paid the Government nine-tenth of the whole collection and kept the rest as his collection charges, after that the right of collecting land revenue started for a pargana or a district and they were sold by public auction to the highest bidders. Due to this, the great exploitation of the farmers started. The revenue farmers became more dominant. This revenue farming system which started during the *Mughal* rule in Bengal was soon extended to the other parts of the country. In United Provinces and Punjab revenue farmers succeeded to gain certain aristocratic rights. The distortions and disorders in the revenue system resulted in many complexities of land tenures and rights. Under British Rule, there three main land tenure systems were prevalent in India. They were *Zamindari, Mahalwari* and *Rayatwari*.

Zamindari:

This system in India was introduced by Lord Cornwallis in Bengal in 1793. He got a particular percentage of the land revenue collected from the farmers. Under this system, the land of the village or few villages was held by one person or few joint owners who were responsible for payment of land revenue to the Government. These middle men or the land lord grasp land revenue from the small farmers and pay it to the Government. There used to be number of intermediaries between the Zamindars and the actual tillers of the soil. The system later acquired various forms such as Zamindari, Jagirdari, Inamdari, etc. In this system of land tenure farmers do not have direct relation with the Government thus they are subjected to all sorts of exploitation. This system was prevalent in Bihar, Uttar Pradesh, Orissa and state of Madras. This system of land tenure had various qualities as well as drawbacks. This system worked well where the Zamindars were educated and feels the importance of the land reform and improvement in agriculture. This system did not worked well where the Zamindars were interested only in collecting land revenue.

Mahalwari:

In this type of land tenure system, not only the single person or the Zamindar was responsible for payment of the land revenue to the government but other farmers of the village were also responsible for it. Residents of a village were collectively and sincerely responsible for payment of the revenue. In such a type of land tenure there was also a head of various Zamindars, here also the farmers did not have direct links with the Government. This type of system was prevalent in Uttar Pradesh, Madhya Pradesh, and Punjab etc.

In this system, common farmers were not happy. They suffered from exploitation and also many other drawbacks were incorporated in this system. In this system land lords who were known as 'Mahalbords' had full control over the internal arrangement and so they exploited farmers as by imposing faulty rules of revenue collection. In this system, the rights of the village lands were held jointly by the village communities, the members of which were jointly and severally responsible for the payment of the land revenue. Land revenue was fixed for the whole village and the village headman called as *Lumberdar* collected it, for which he received 'Panchatra' i.e. 5 per cent as commission.

Rayatwari:

In this type of land tenure system, the property rights of the land vested on the Government; farmers paid the revenue to the Government, for cultivation on that land so long as the farmer paid the revenue, he could not be rejected from the land. Previously, this system was prevalent in Madhya Pradesh, Bombay, Assam etc. but latter spread in almost all the states where Zamindari and Mahalbari system have been abolished. This is the only system of land tenure in which farmers have the direct relationships with the Government. It was also helpful for the Government as when the land increases the revenue also increases. The farmers also have right over the land so that they were interested in improving and making it useful and more economic.

This system was controlled by the Government employees and they create trouble to the farmers so many times. Firstly system was introduced by *Sir Thomas Munro* in 1820 in the Madras State and after that in Bombay State. Every registered land holder was recognized as proprietor and he could sell or transfer the land rights to others. It was a better system as compared to Zamindari or Mahalwari and various other forms of tenure.

3 CONSOLIDATION SETUP

Agriculture Census in India is conducted at the interval of five years for collection of information/data about the structural aspects of farm holdings in the country. The basic unit for data is the area under operational holding. In general Agriculture Census data is collected in three phases - first on primary subjects like the numbers and area of operational holdings, then a detailed survey based on samples from 20 percent of villages on tenancy, land use, irrigation and finally on the patterns of input use in agricultural production. In India land holding size is very small on an average of 1.15 hectares as compared to land holding of USA (158 hectares) and Canada (1993 hectare) but bigger than the land holding size of Japan which is only one hectare. Main culprit of small size of land holding in India are continuously increasing population, low of inheritance, fragmentation of joint families, rural debts and decline of craft and cottage industries. Small land holdings are not beneficial for the use of modern tools and techniques, diffusion of HYV seeds, fertilizers, etc. and also not economically viable, wastage of land is at the peak. All these problems can be reduced by adopting the proper land consolidation methods.

In India land consolidation mainly done by the government but consciousness and awareness of farmers is also important in this regard.

Land consolidation pragramme was implemented successfully in the states like Punjab, Haryana and Madhya Pradesh. Various efforts are taken to successfully implement this programme in Bihar and Jammu and Kashmir. But at latest only 49% agricultural land has been consolidated and remaining 51% is still waiting for land consolidation in the country effecting agricultural production a lot.

4 LAND REFORMS

Land reform is a broad term, refers to the reforms of institutional factors related to land in order to promote the agricultural production and also to raise the level of income and standard of living of the farmers in India or it refers to an institutional measure directed towards changing the existing pattern of land ownership; tenancy rights and management of land. Institutional factors along with technical factors play an important role in agricultural production. These institutional factors include land tenure system, land holdings size; farming structure, land distribution, intermediaries present etc.

Major land reform measures have been introduced time to time by various underdeveloped and developing countries in the world for achieving a rational land distribution pattern and feasible farming structure. In most of the underdeveloped countries land reforms are among one of the main foundation stone of agrarian policy. The term 'land reforms' encompasses two different meaning; in a narrow sense, land reforms are concerned with the reforms related to land ownership and land holdings. But in a broader sense, the term 'land reforms' is used to mean those measures of reforms necessary to raise production of crops by increasing agricultural productivity; include reforms concerning to rent fixation on land, abolition of intermediaries, credit and marketing arrangements, etc. In order to attain institutional changes in agriculture land reforms are considered effective. Prof. Gunner Myrdal argued, in this connection, that the "Land reforms are a planned and institutional reorganization of the relation between man and land."

Although, agriculture is the main occupation of population in India, yet it is backward. Agricultural productivity in India is still very low as compared to other countries of the world. At the time of independence, there were many unfair systems of land tenure were in action that

deprived a large number of farmers throughout the country. The ownership rights were faulty. There was Zamindari system prevalent in India. The farmers own very small and limited pieces of land which was not viable socially and economically. The problems of fragmentation and uneconomic holdings were resulting into low crop productivity. The institutional factors like-the feudal structure of society, the small size of land holdings, the presence of Zamindars or intermediaries, high land rents and insecurity of tenancy rights led to the backwardness of society and agriculture too. After independence, country felt the greater needs of the land reforms to heal the socio-economic structure of rural India and to stop exploitation of the genuine tilters of the land and pass on the ownership rights to them.

The major objectives of land reform in India were as follows:

1. Restructuring the faulty agrarian structure to achieve democratic structure
2. Abolition of intermediaries
3. Land consolidation measures and check land fragmentations
4. Land ceiling
5. Elimination of exploitation of farmers and actual land tillers
6. Actualization of the goal of 'land to the tiller'
7. Improvement of socio-economic conditions of the rural poor by extending their land base
8. Increasing agricultural production and productivity
9. Facilitating land-based development of rural poor
10. Achieve the goals of sustainable growth and social justice

Measures of Land Reforms in India:

Abolition of intermediaries:

At the time of independence, different intermediaries like Zamindars, Talukdars, Jagirdars and Inams were dominated the agricultural sector in India. Thus the top priority of the then government was abolition of these intermediary tenures. Soon after the independence, measures for the abolition of the Zamindari system were adopted in different states of India. The first Act to abolish intermediaries was passed in 1948 in Madras state. Since then, state after state passed legislation to abolish the Zamindari rights. In 1951 Orissa Estates Abolition Act was passed. By the year 1955, the progress for the abolition of intermediaries had been completed in almost all the states of India. As a result of these measures, about 2.5 crore farmers were brought

into direct relationship with the State and facilitated distribution of about 61 lakh hectares of land to the landless farmers. Large areas of privately-owned forests and wasteland now were under the ownership of the State. Despite the abolition of intermediaries at a large scale, poor farmers were continued to be exploited in various ways thus a large-scale of poor tenants leave the agriculture. While land lordship has been abolished but absentee land lordships were continues to flourish.

All this happened because the law permitted the intermediaries to retain their home farms, no limits were put on the area of land they could retain, the term 'personal cultivation' was nonspecific i.e. poorly defined and proper protection was not given to actual tenants. Undoubtedly, this abolition of intermediaries paved the way for an outstanding move regarding agricultural reforms in India but the goal of "land to the tiller" is yet to be achieved.

Tenancy Reforms:

Land tenancy refers to the relation between the land holder i.e. land owner and the actual tiller of the land. Many land owners did not cultivate their lands personally but gave it to some other tiller and receive rent for that land called as 'absentee landlords'. Tenancy legislations have three steps for instance, regulation of rent, providing security of tenure, and give rights of land ownership to the tenants.

According to the rules rent payable to the landowners should not exceed one-fifth to one-fourth of the gross produce of land in any condition; but large inter-state variations are widespread in actual fixation of land rent rates. Tenancy legislations have made it clear that in no case the tenants can be expelled except only in the situation where landlords themselves want to continue agriculture. Even in the event of resumption of cultivation by the owners, tenancy legislations have made it obligatory to leave a minimum area for the tenant. But overall impact of tenancy reforms is very limited. Firstly, tenancy laws have been violated all around the country. For instance, in Bihar and Uttar Pradesh, the maximum limit of rent was at 25 % of the gross produce but tenants are paying 50% or more of gross produce due to various social conditions. The tenants are exploited by the land owners by way of heavy rents (50 per cent or even 2/3rd of the produce). There are no protections of tenure and there are no any incentives have been provided to the tenants to make land enhancement and increase production.

Ceiling on land holdings:

Second five year plan (1956-1961) recommended the obligation of ceilings on agricultural holdings to reduce the existing disparities in the pattern of land-ownership and make some land available for distribution to the landless agricultural laborers. It was visualized and fixed that land above a certain fixed limit would be acquired by the State and redistributed among the landless laborers and to the small farmers, to create economically viable land holdings in all the states.

There were two phases in the land ceiling laws. In the first phase 'landholder' was treated as the unit of the farming but in second phase after 1972 it was changed to 'family' and ceiling limits were lowered. But exclusion of orchards, sugarcane plantations, grazing lands, cattle-breeding farms, religious, charitable and educational trusts, tanks, and fisheries etc. have made the ceiling laws almost disused. Total amount of land declared surplus was 73.67 lakh acres in September 2001 and about 64.95 lakh acres of land have been taken over by the states and 53.79 lakh acres of land have been distributed among 54.84 lakh tenants in the country. About 12 lakh acres of land could not be distributed due to variety of reasons. The operations of the ceiling law made virtually no impact on the agrarian structure. The enforcement of the ceiling law delayed for several years which enabled landowners to manipulate land records at a large leading to fictitious (benami) and fraudulent partitions of lands among their relatives, friends, fictitious trusts, etc. Mainly due to a wide range of exemptions provided in the ceiling laws, various shortcomings and loopholes in the laws and ineffective implementations of the laws ceiling of land holdings actually failed leaving some small landowners who were caught in the net and most of the big landowners were escaped. Land was not acquired and was not redistributed among the landless peasants leaving some exceptions. Lack of political willing can be considered as the greatest hindrance in the speedy implementation, acquisition and redistribution of land to the land less laborers and small farmers in India.

Consolidation of land holdings:

Fragmented, separated and erratic land holdings with very small size have made Indian agriculture totally unrealistic, unsustainable and unprofitable. Consolidations of these fragmented and small sized farms are necessary to improve the efficiency and economic viability of agriculture in India and raise the living standards of rural population and farmers. Land

consolidations have been completed in the states of Punjab, Uttar Pradesh and Haryana in India till 2001. Very less area, about 163.3 lakh acres (1/3rd of the total cultivated area) in India have been consolidated so the success story of land consolidations is rather disappointing. Small farmers have a strong fear that consolidation favours large farmers; they don't want to avail land consolidation measures due different social and economic problems also.

70 years after independence, land reforms in India are not fully implemented. There are huge ambiguities in the land reform laws and their implementation is also defective. Poor governmental implementation mechanism, corrupt bureaucrats, and officials etc. are the main culprit of failure to land consolidation measures in India.

Co-operative farming:

Co-operative farming has been promoted to solve the problems of frequent small sized and fragmented holdings in India. In this system, farmers pool their small sized land holdings for farming and reap the benefits of large scale farming with the help of co-operatives. It is a type of group farming dome in co-operation. Thus the advantages of technical farming, HYV seeds and adequate use of irrigation and fertilizers can be gained by the co-operative farms and farmers; co-operative farming lays the base of strong democratic sense, self and mutual help. But in India co-operative farming is not in strong position due to different social structure, likes and dislikes, and prejudice of the India population. Co-operative farming in India has largely been a failure. The attitude of the bureaucrats and of the Indian farmers towards the co-operative farming is not much positive.

Bhoodan Movement:

Acharya Vinoba Bhabe was the precursor of the 'Bhoodan Movement' in India. In this movement he collected land from the rich landlords and distributed that land to the landless peoples. About 4.2 million acres of land were received as 'Bhoodan', but so far only about 1.3 million acres have been distributed among landless population. Presently this movement is in the demise.

Compilation and updating of land records:

Collection and renewal of the land records are prerequisite and an essential condition for the successful and well-organized implementation of land reform programmes. In recent time in

India the states have been advocated to take all measures for updating land records with the highest urgency by adopting a time-bound programme. Efforts are also being made to maintain the land records in digital forms with the help of computers, scanners and digitizers; in this regard GIS is an important tool for land record up gradation, preservation and management.

Causes of failure of land reforms in India:

There are a number of causes for the failure of the land reforms programmes in India. Among them some important ones are as follows:

1. Unnecessary publicity and delay in passing land reform laws: Much publicity of the proposed land reforms and the time taken for a bill to become an Act in many states has been unusually long. This has enabled the landowners to make essential alterations in the provisions of land reform legislations.

2. Ambiguous definitions of various terms: Various terms related with the land reforms are not well explained thus chances of miss interpretations are huge. For example the term 'Personal cultivation' is relatively loose. One could recommence land for personal cultivation easily under the definition living very distant from the land. The Zamindars have been permitted to hold large areas of land for agriculture. The land reform laws have provided immunity to the land awarded for bravery, land under orchards and sugarcane, tea estates, efficient farms, trusts, educational, and religious land etc.

3. **Optional nature of the laws:** Most of the land reform laws which grant ownership rights to the tenants are not mandatory rather are optional. The tenants have to go to the government offices for grant of ownership rights on land. They will not get them automatically. On many occasions, tenants hesitate to approach the courts for this purpose just only due to fear of the rich landlords and corrupt official.

4. Malafide transfer of land: To cheat and defeat the noble cause of land ceiling and laws relating to land ceilings, the Zamindars and landlords have indulged in large scale transfer of land to their family members, relatives, and friends. Due to such faulty practices no real changes has been felt in the operational agriculture scenario.

5. Lack of social consciousness among the tenants: Social consciousness of the tenants is a major factor responsible for the successful implementation of land reforms in India. Due to lack

of awareness and consciousness of the farmers goals of land reforms, land consolidation and land ceiling have been not achieved yet. Everyone has to fight for his rights and those farmers too.

6. State takes side of the big farmers: It can be witnessed in many cases that state plans and policies favours big farmers and landlords rather small farmers so that the interests of the small farmers have been critically affected.

7. Lack of political willpower: The programme of land reforms requires adequate political wish, enthusiasm and support at all stages of land reforms whether it is the case of law and act formation or implementation. But unfortunately the political leaders wear a mask of progressive socialistic attitude they only do the politics not the reforms, the lack of political will is fully demonstrated by the large gaps between policy and legislation and between law and its implementation in reality.

8. Bureaucratic corruption: Land reforms implementation provides a golden opportunity to the 'Patwari' and other revenue officials and functionaries of the Revenue Department to make easy money. In many cases the highly placed officials in the revenue and administrative departments are themselves landlords. Some honest officials implement the laws of land reforms sincerely, but they face unnecessary difficulties and problems from landlords and politicians of our country.

9. **Surplus land is fallow and uncultivable land:** The land holders of surplus land manipulate the land data in such a way that the land in excess in their possession is usually barren and uncultivable. Such a surplus land does not yield any benefit to the landless peasants. In this way the very purpose of land reforms legislation is defeated.

10. **Absence of records:** Absence of land records regarding ownership and possession in India is a common case.

11. Lack of uniformity in land reforms laws: Land reforms laws are not uniform throughout the Indian states. Different laws among various Indian states, accounts for the slow development of land reforms measures in the country.

11.4 SUMMARY

Various institutional factors like land holdings; size and fragmentation, land tenancy, and land reforms are importantly fix the agricultural production and productivity in India and the links of farmers to the land. In India most of the farmers hold marginal land holdings with fragmented farms, tenancy is also very faulty and various traces of landlordships, zamindari, mahalwari and rayatwari, lumberdari systems etc. can be seen throughout the Indian states. Land reforms are saying the story of failures; farmers are leaving agriculture and seeking jobs in cities. All these are big hindrances in the agricultural growth and development and use of modern tools, techniques and innovations in agriculture in India. Shares of agricultural in employment generation and GDP are decreasing continuously.

A number of land reforms have been implemented time to time in India but they are not providing fruitful results till date. Agriculture is not a viable economic activity for most of the farmers in India as most of them are of small and marginal. Farmers can't use highly developed tools and techniques, HYV seeds and chemical fertilizers due to prevalent social and economic constraints. Various remedial measures have been made to remove the difficulties and structural constraints pertaining to land reforms in India. India is characterized by a tradition of inequality and exploitation of the poor farmers all the ages, the land reform measures can lead to a real burst of enthusiasm, a genuine release of energy among the farmers and crop production and productivity can be raised many times.

Needs of the present is the proper implementation of land reforms. In order to remove hindrances prevalent in agricultural institutions in India the poor should be motivated through education and extension services and the rich should be compelled to cooperate through compulsion. It certainly requires a government with strong political spirit and bureaucracy which is committed to achieve the desired land reforms results.

To cope up with these problems and to increase the viability of agriculture among farmers efficient formulation and implementation of land reforms are must. Government with strong will power can do the miracle. People's participation, education, research and innovations are required for making agriculture more economic so that the living standards of the poor farmers can be raised.

11.5 GLOSSARY

1. HYV- High Yielding Variety

2. GDP- Gross Domestic Produce

3. Bhoodan- donation of land

4. Co-operative- an autonomous association of persons united to meet common social, economic and cultural goals

5. Land holding- land owned or rented

6. Tennant- one who has temporary possession of land

7. Ceiling- fixing maximum size of land holding

8. Consolidation- combining a number of things into one

9. Inheritance- practice of passing property to the descendants

10. Reforms- make change in order to improve

11.6 ANSWER TO CHECK YOUR PROGRESS

1. Factors relating to, or managed and formulated by an institution are known as institutional factors.

2. Land holding size, practiced traditions, land reforms and prevalent land tenure systems are the major components of Institutional factors.

3. The term 'agricultural holding' designate average size of agricultural land held by the farmers in India

4. operational land holding in India is a unit of land used wholly or partly for agricultural production and operated by one person alone or with the support of others members

5. 1.41 hectare was the average size of land holding in India in 1995-96.

6. 67 percent of agricultural land was detained by the marginal farmers in 2010-11.

7. Land tenancy refers to the system in which land is held by an individual from government

8. Three tenure systems were prevalent in India during the British rule.

9. Zamindari, Mahalwari, and Rayatwari were the name of tenure systems in British rule.

10. Lord Cornwallis in 1793 introduced the Zamindari system in India.

11. Sir Thomas Munro in Madras state introduced the Rayatwari system in India.

12. Maximum limit of land one can retain is land ceiling.

13. A type of group farming in co-operation is Co-operative farming.

14. Acharya Vinoba Bhabe was the initiator of Bhoodan movement.

11.7 REFERENCES

1. Chauhan, Dharmendra Singh (2010): "Agricultural Geography", Ritu Publications Jaipur, India.

2. Gautam, Alka (2012): "Agricultural Geography", Sharda Pustak Bhavan Allahabad.

3. Husain, Majid (1996): "Systematic Agricultural Geography", Reprinted 2007, Rawat Publication, Jaipur and New Delhi.

4. Mamoria, Chaturbhuj. (1992): "Adhunik Bharat ka Brihat Bhoogol", Sahitya Bhavan, Agra.

5. Ojha, S.S. "Bharat ka Bhoogol". (2005): Bhaugolik Adhyan Sansthan, Govindpur, Allahabad.

6. Singh, J. and Dhillon, S.S. (2nd ed.). (2000): "Agricultural Geography", Tata McGraw Hill, New Delhi.

7. Tiwari, R.C. (2004): "Geography of India", Prayag Pustak Bhawan, Allahabad.

8. Agriculture Survey of India, 2017-18.

9. Economic Survey of India (vol.1st and 2nd). Oxford University Press, New Delhi.

10. Indian Budget, 2017-18.

11. Industrial Survey of India, 2107-18.

12. Khan, A. S. (1968): "Technological Change and Their Diffusion in Agriculture, Problem of Agriculture development in India", Edited by Dr. S. S. Jain, Kitab Mahal, Alahabad.

13. Khan, A. S. (1968): "Technological Change and Their Diffusion in Agriculture, Problem of Agriculture development in India", Edited by Dr. S. S. Jain, Kitab Mahal, Alahabad.

14. Lekhi, R. K. and Singh, Jogindar (2012): "Agricultural Economics", kalyani Publishers, Ludhiana, New Delhi

15. Sharma, T. C. (1999): "Technological change In Indian Agriculture. A Regional Perspective", Rawat Publications, Jaipur and New Delhi

16. Singh, J. and Dhillon, S.S. (2nd ed.). (2000): "Agricultural Geography", Tata McGraw Hill, New Delhi.

17. Singh, Jasbir and Dhillon, S. S. (1984): "Agricultural Geography", Tata Mc Graw Hill publishing company Limited,

18. Singh, L.R. (ed.). (1987): "India: A Regional Geography", New Printindia Pvt. Ltd., Ghaziabad, U.P.

19. Symons, L. (1968): "Agriculture Geography", G. Bell and Sons Ltd. London.

20. Taylor, James A. (1968 ed.): "Weather and Agriculture", Oxford: Pergamon.

21. Young, Arthor. (1770): "Environment and Cropping Patterns in England".

11.8 TERMINAL QUESTIONS

A. LONG QUESTIONS

1. Define the institutional factors and their role in agricultural development in India?
2. What do you mean by land reforms? Elaborate the important land reforms done in India?
3. What are the major objectives of the land reforms and also discuss the various causes responsible for failure of land reforms in India?

B. SHORT QUESTIONS

1. What is the meaning of institutional factors?
2. Write major components of institutional factors?
3. Define agricultural land holding?
4. What do you understand by operational holding?
5. What was the average size of land holding in India in 1995-96?
6. What percentage of agricultural land detained by marginal farmers in India in the year 2010-11?
7. What do you mean by land tenancy?
8. How many tenure systems were prevalent in India during British rule?
9. Name the tenure systems during British rule?
10. Who introduced the zamindari system in India and when?
11. Who introduced the rayatwari system in India and where?
12. Define the term land ceiling?
13. What is co-operative farming?
14. Who was the initiator of Bhoodan Movement?

C. MULTIPLE CHOICE QUESTIONS

Q- 1 Meaning of agricultural holding?

1. Agricultural land size determined by the government.

2. Cultivable land area.

3. Non Agricultural land management.

4. None of the above.

Answer- 1

Q-2 What is Operation HD Bollarding?

1- Animal Husbandry Unit

2- Poultry Production Unit

3-Crop Production Unit

4- all of the above

Answer - 4

Q-3 What is the number of agricultural holdings in India?

1- One

2- Two

2- Three

4- Five

Answer- 4

Q-4 The size of the marginal landholding?

1- Blow 1 hectare

2- 2 hectares

3- 3 to 4 hectares

4- 4 to 10 hectares

Answer-1

Q-5 In what total area is marginal land operated in India?

1- 50%

2- 40%

3- 45%

4- 55%

Answer- 3

Q-6 Who started the Zamindari system in India?

1- Lord Ripon

2- Lord Karnvalish

3- Lord macaulay

4- None of the above

Answer- 2

Q-7 Who had the rights on the land in the Rayatwari system?

1- Public

2- Government

3- NGO

4- None of the above

Answer-2

Q- 8 Intent of land reform.

1- To consolidate

2- To provide l chemical fertilizers to farmers.

3- To increase agricultural production.

4- All of the above

Answer- 3

Q-9 The main objectives of land reforms in India are?

1- To consolidate.

2- Increase agricultural crop production

3- Abolition of intermediaries

4- All of above

Answer- 4

Q-10 How many stages are there in tenancy reform

1- 2

2- 3

3- 5

4- 8

Answer-3

UNIT-12 INDUSTRIAL SCENARIO

12.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Know the meaning and types of industries
- Link the role of industries in economic development of the country
- Understand the linkage between industry and employment generation
- Know prospects, changing scenario and problems faced by the industrial sector in India
- Deal with the solutions to the problems prevalent in diverse industries of India

12.2 INTRODUCTION

Industry refers to an economic activity, concerned with the production of goods, extraction of minerals and to provide the services to the population for instance, iron and steel, cement, food processing and textile industries are related with the production of goods, coal mining industry linked with the extraction of coal and banking, health, education, entertainment and tourism industries are service providers.

Industries can't be locate anywhere as they have some basic requirements and facilities; major factors affecting the location of industries are the availability of raw material, adequate land, proper water supply, cheap skilled and unskilled labour, efficient power sources, abundance of capital, competent transportation network and market to sale the produce. Industries can situate where, there some basic or all of these factors are easily available. Government's role is also important as they facilitate basic infrastructure and incentives like subsidized power, lower transport cost and other infrastructure so that industries may be located in backward areas. Industrialization often leads to the development of that area where they locate and also of its nearby areas and from base to the other developments like development of agriculture, trade and commerce, varied economy and services.

12.3 TYPES OF INDUSTRY

In general industries can be classified in multiple as on the basis of type of raw materials used, their size and ownership of industry, or nature of produce etc. various types of industries are as follows:

1. Raw material based industries:

These industries are defined by the type of raw material used in them. These further may be classified as agro-based, mineral based, marine based and forest based industries depending upon the type of raw materials used in them. Agro-based industries use agriculture based products as their raw materials for instance sugarcane, food processing, vegetable oil, cotton and

jute textile, rice and flour mills, dairy products and leather industries are the examples of agro-based industries. Mineral based industries are those use mineral ores as their raw materials. The products of these industries provide base to the other industries.

For example iron ore is the product of mineral based industry provides base to iron and steel industry. Aquatic/ marine based industries use products from the sea and oceans as their raw materials. Industries processing sea food and manufacturing cod liver oil are some examples of marine based industries. On the other side forest based industries utilize the raw materials from forests and process them into valuable products. The industries associated with forests are paper and pulp, pharmaceuticals, honey, lac, varnish and paint, furniture and buildings materials etc.

2. Industries according to their size:

Based on the size, industries can be classified into two group small scale and large scale industries. These industries count the amount of capital invested, number of people employed and the volume of production by them. Cottage or household industries are a subtype of small scale industries where products are manufactured by hand or very less mechanization, by the craftsmen in their homes without or very limited use of power sources. For instance pottery, various handicrafts, and basket weaving etc. are the examples of cottage industry or house hold industries. Small scale industries are those who use lesser amount of money and mechanization, lesser labours and lesser production as compared to large scale industries that produce huge volumes of products. Investments of capital are higher and the technology used is of superior quality in large scale industries. Silk weaving and food processing industries are the examples of small scale industries whereas production of automobiles, cement, ship manufacturing and heavy machinery like tractors, harvesters, etc. are large scale industries.

3. Industries according to ownership:

According to ownership rights industries can be classified into various sub-categories like private sector, state owned/public sector, joint/mixed sector and co-operative sector. Private sector industries primarily owned and operated by individuals or a group of individuals. The public sector industries are owned and operated by the state/government. Joint/mixed sector industries are owned and operated jointly by the state and individuals or a group of individuals while co-operative sector industries are owned and operated by the group of peoples like Amul etc.

(A) Mineral based industry (Iron and Steel, Aluminum Industry, Cement Industry)

IRON AND STEEL INDUSTRY:

Being a developing country, Iron and Steel Industry has a very important role to play in India's future developments. The production of steel is regarded as one of the key feature and prerequisite for modern industrial development. Iron and steel industry is the basic industry of India. Speedy growth, development and industrialization of the country requires rapid development of iron and steel industries as they make available to the base to the development of other industries in the country. Development of agriculture, transportation and communication facilities, machine and tools making industry, electrical and electronics, machinery producing industry, consumer goods and service industry, and many more; are all depend on the development and expansion of iron and steel industries of the country. The development of iron and steel industry in India can be traced from very ancient times and for instance, can be witnessed by the iron beam of the Konark Temple of Orissa and the 7 meters high iron pillar near Qutab Minar in Delhi. Actual foundation of large scale production of iron and steel through modernized methods was started with the establishment of Tata Iron and Steel Company (TISCO) by Jamshed Ji Tata since 1907. Indian Iron and Steel Company (IISCO) was established in Burnpur near Asansol in 1919. In 1923 Mysore Iron and Steel Company was established in private sector near Bhadrawati in Karnataka; presently it is known as Visvesvaraya Iron and Steel Works Ltd. In second Five Year Plan (1956-61) government has established Hindustan Steel Limited and four other industries were established with the help of foreign located in Rourkela, Bhilai, Durgapur and Bokaro.

All the raw material used in iron and steel industry are heavy and weight loosing nature thus this industry can't locate anywhere. The raw materials for iron & steel industry include iron ore, fuels like coal and coke, limestone, dolomite, silica, manganese, nickel, tungsten, etc. are also used in this industry. These industries also need plenty of water and electricity. Recycling of scrap matter to produce new steel is also very common. Iron and steel industry preferably located near the sources of raw materials.

Later on, since the introduction of Fourth Plan steps was also taken for the development of three more steel plants one each at Salem, Vijaynagar and Visakhapatnam. In 1974, the Steel Authority of India Limited (SAIL) was created for the development of steel industry, for supplying major inputs to the industry and also to bring a coordinated and synchronized development of all the major industrial units under its control. Major units were: Hindustan Steel Limited, Salem Steel Limited, Hindustan Steel Works Construction Limited, Bharat Coking Coal Limited and National Mineral Development Corporation Limited. The management of TISCO is also undertaken by SAIL. The SAIL is at present an integrated steel company with five public sector steel plants. At present about 70 per cent of domestic steel requirement is only met by SAIL. The steel industry is providing direct employment to more than 4 lakh workers. With crude steel production of 81.2 million metric tons, India is ranked as the fourth largest steel producing country in the world.

But, India is still lacking in respect of production of steel. Thus, a large gap between the consumption and production of steel still persists in domestic fronts. To meet this gap India is to import steel every year.

Problems of Iron and Steel Industry:

The iron and steel industry of the country is facing various problems. Major problems of iron and steel industry in India are-

1. Steel companies are overwhelmed with huge debts
2. Lack of domestic demand of higher grade steel
3. Low quality of metallurgical coke for blast furnace iron making
4. High input costs
5. Cheap imports from China, Korea and other countries are also a matter of concern for domestic producers
6. Inadequate supply of power and coal
7. Inefficiency of public sector units
8. Under-utilization of capacity
9. Lack of finance
10. Lack of technically trained workers
11. Sickness of mini steel plants
12. Problem of administrations
13. Increasing demand of iron and steel in recent years
14. Higher dependency on foreign investment
15. Problem of transportation for carrying raw materials and processed goods
16. Industrial disputes
17. Excess staff
18. Large demand and supply gap
19. Increasing global competition
20. Rise of cost of inputs continuously
21. Environmental concerns

Suggestions to solve the problems of iron and steel industry:

1. Improvement and up gradation of technologies,
2. Arrangement for the supply of best quality coal,
3. Full utilization of its capacity,
4. Diversification of production,
5. Adoption of efficient management of public sector steel units,
6. Solution of labour disputes,
7. Arrangement for proper training of workers,
8. Development of small factories and
9. Attaining stability in the increasing prices of the steel.

10. Liberalization of Steel Policy
11. Advancement of old machinery
12. Adequate and easy capital arrangements

In order to face these problems, the iron and steel industry needed a comprehensive planning for modernization, up gradation of technologies, replacement of obsolete equipment and removal of technological imbalances.

ALUMINIUM INDUSTRY:

Aluminum industry is the second largest metal industry of India after iron and steel industry. Aluminum is also the 3rd frequently available element present in the earth's crust and the 2nd most used metal after steel. Aluminum is one of the lightest metals in the world. Metal is highly conductive of electricity and has soft nature so can be bend without breaking as a result it is used widely in the production of multiple products throughout the world. Naturally, Aluminum is found in an ore called "bauxite" thus bauxite is the basic raw material used in the Aluminum manufacturing process. Among all the industries, Aluminum industry is perhaps youngest. Aluminum was discovered only in 1886. Although bauxite, the principal ore of Aluminum, is abundant all over the earth's crust, its concentration of sizable amount is rare. Bauxite is converted into alumina in refineries. According to USGS India's rank is 9^{th} in terms of bauxite reserves in the world. Aluminum is produced by two different methods, the primary production process which involves the conversion of ores to Aluminum and the other is secondary production (recycling) where the Aluminum scrap is recycled to produce Aluminum again. In India primary Aluminum industry is dominated by 3 companies: Hindalco and Vedanta which are privately owned and National Aluminum Company Ltd. (NALCO) which is a public sector undertaking having a Navratna status.

First attempt to manufacture Aluminum in India was started when Aluminum Corporation of India (ACI) was formed in 1937. But its first venture to produce Aluminum was delayed. Meanwhile, Indian Aluminum Company (IAC) started its production at Aluminum in Kerala. To give a moral as well as financial boost to the industry, the Government announced in 1940 several facilities including import tax exemption and imposition of heavy duty on imported Aluminum. Finally, Aluminum Corporation of India was able to start its production at Jaykeynagar. In 1958, Hindustan Aluminum Corporation (HAC) was incorporated. This company constructed a giant plant at Renukot in Uttar Pradesh which started production in 1962. Subsequently new plants were set up at Mettur of Madras (1965) in the name of Madras Aluminum Company and in the same year Bharat Aluminum Company Limited (BALCO) was established in public sector. Plants of BALCO are situated in Korba of Madhya Pradesh, Ratnagiri in Maharastra and Ambikapur of Chattisgarh. In 1981 National Aluminum Company Limited (NALCO) was established in Koraput of Orissa.

But due to the huge demands India has to import a large volume of Aluminum yearly. At the initiation of the First Five Year Plan, total Indian Aluminum production was only 4 thousand tones. Production increased to 18,000 tons in 1960-61. Production surpassed 160,000 tons in 1970-71. Finally, after expansion of the old units and construction of Korba and Angul projects, production crossed the modest total of 350,000 tons in 1988-89. During 2004, production of Aluminum is estimated to be slightly higher than .88 million tones, as compared to .624 million tons in year 2000. The chronic power shortage disrupted normal production in many plants.

Due to heavy demand of energy in the conversion of alumina from bauxite, it was not possible to raise the production, despite massive bauxite reserves in the country. Special care had been taken to improve hydel-power projects for the development of Aluminum industry as hydel-power is much cheaper and economic than any other form of energy. Despite massive increase of Aluminum production, overall performance of Indian Aluminum industry is not at all Satisfactory. Since inception, the industry had to overcome several problems. The major problems among these are lower productivity, high cost of energy, uneconomic size of the plants, lack of good quality raw materials, etc. To overcome these difficulties, production cost of Aluminum should be reduced drastically, modern methods of alumina reduction should be introduced and plant-size must be made economically viable.

Recycling of Aluminum products is being emphasized as a facilitator of future growth of the industry. Products such as cans, Aluminum foils, plates and automotive components can be easily recycled thereby saving energy and reducing greenhouse emissions; it is interesting to note that more than 63% of all Aluminum cans are recycled worldwide. Recycling of Aluminum uses only 5% of the energy required for primary production and emits only 5% of the greenhouse gases.

CEMENT INDUSTRY:

Cement is a substance used for building construction that sets, hardens and adheres to other materials by binding them together. Cement is seldom used single; cement is used with other fine material like sand and gravels to produce concrete. India is the second largest producer of cement in the world. India's cement industry is a vital part of its economy, providing employment to more than a million people, directly or indirectly. It was deregulated in 1982; the cement industry has attracted huge investments, both from Indian as well as foreign investors since then. India economy is at boost and the country has a lot of potential for further development due to recent major initiatives as development of smart cities, developing real estate and housing sector, construction and infrastructure sector are all going to benefit the cement industry in India. Several foreign based companies are investing in the country. Availability of the raw materials for making cement, such as limestone and coal are essential for development of cement industry.

The housing sector is the biggest consumer of cement and generates huge demand, accounting for about 67 per cent of the total consumption of cement in India. The other major consumers of cement are infrastructure sector by 13 per cent, commercial construction at 11 per cent and industrial construction sector at 9 per cent. India's total cement production capacity was nearly 425 million tonnes, as of September 2017. The growth of cement industry is expected to be 6-7 per cent in 2017 because of growing housing sector and the government's focus on huge infrastructural development. The per capita consumption of cement is around 225 kg/ person and expected to rise in near future. A huge concentration of cement plants can be seen in the states of Andhra Pradesh, Rajasthan and Tamil Nadu as of 210 large cement plants, 77 are located in these states.

Due to the growing demand, increased construction and infrastructural activities, the cement sector in India is seeing numerous investments and developments in recent. According to data released by the Department of Industrial Policy and Promotion (DIPP), cement and gypsum have attracted Foreign Direct Investment (FDI) worth US$ 5.25 billion between April 2000 and December 2017. In order to help the private sector companies thrive in the industry, the government has been approving their investment schemes. In of Budget 2018-19, Government of India announced setting up of an Affordable Housing Fund of Rs 25,000 crore under the National Housing Bank (NHB) thus it is expected that it will boost the demand of cement from the housing sector.

India is the second largest cement producer in the world and accounts for 6.9 per cent of world's cement output. It is expected that due to the increased demand in housing, commercial construction and industrial construction, cement industry is expected to reach 550-600 million tonnes per annum (MTPA) by the year 2025.

(B) Agro Based Industry (Cotton Textile, Jute textile, Sugar Industry)

COTTON TEXTILE:

India is one of the important cotton-manufacturing countries of the world. Both short-staple and long-staple cotton is grown in the country. Cotton textile industry is an important, ancient and largest organized industry of India. Lakhs of peoples are directly engaged in cotton industry and also lakhs of peoples are indirectly supporting and in response supported by the cotton textile industry in India. Cotton growers, power loom and hand loom operators, traders etc. indirectly gain livelihood from cotton industry. India ranks second in cotton textile manufacturing in the world. The textile industry in India traditionally, after agriculture, is the only industry that has generated huge employment for both skilled and unskilled labour and accounts for a large portion of the total industrial output in the country each year.

Before 5000 years, fine quality cotton textiles were weaved in India. Traces are available from Mohenjo-Daro and Harappa. The cotton textile industry in India was initiated with the establishment of the first cotton textile factory at Fort Gloster near Kolkata in 1818. However, it

was closed very soon due to the shortage of raw material. Actual development of the cotton industry started after 1854 when cotton textile mill was established by Kawas Ji Davor in Mumbai; which is located in the cotton growing region of Western India. Since then there has been rapid growth of the industry around Mumbai and Ahmadabad. In 1939 there were 389 cotton textile mills in India. But due to the division of country about 48% cotton producing area and 15 large cotton textile mills went to Pakistan was a setback to cotton textile industry in India. After independence serious steps were taken to regenerate the cotton textile industry.

The textile industry continues to be the second-largest employment generating sector in India. It is offering direct employment to over 35 million peoples in the country. The share of textiles in total exports was 11.04% during April–July 2010. In 2010, there were 2,500 textile weaving factories and 4,135 textile finishing factories in all of India. India exports yarn to different countries of the world. Cotton textile industry of India is now in a position to meet the total demand for textiles in the domestic market and with a sufficient surplus for foreign export. India ranks among the largest producer and exporter of cotton textile products. India exports cotton textiles to the countries of Russia, UK, USA, Australia, Sri Lanka, Iran, Germany, Belgium, Italy, etc.

Concentration of Cotton textile centers:

Major factors for the growth of the industry of cotton textile are easy availability of local raw cotton, availability of cheap hydel-power, humid climate required for spinning of the yarn, large capital invested, locally available cheap and skilled labor, good demand for cotton garments and, well-knit transport system etc. Main four regions of cotton textile concentration in India are as:

Western Region: Gujarat and Maharashtra are the most advanced states of this region. Mumbai in Maharashtra and Ahmadabad in Gujarat are two principal centers of this region. Ahmadabad is known as the 'Manchester of India'. The other important cotton textile centers include Nagpur, Pune, Jalgaon, and Sholapur in Maharashtra and Surat, Bharuch, Vadodara, Bhavanagar, Rajkot in Gujarat state.

Southern Region: In Southern India cotton textile mills are located mainly in the states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. Important centers of cotton industry are Madurai, Salem, Tiruchirapalli Chennai, Guntur, Mysore, Pondicherry etc. Coimbatore is the largest cotton textile centre of Southern region.

Northern Region: This region includes the states of Uttar Pradesh, Delhi, Punjab, Haryana and Rajasthan. The principal centers of this region are Kanpur, Delhi, Amritsar, Ludhiana, Agra etc.

Eastern Region: This region includes the states of West Bengal, Bihar, Orissa and Assam. Maximum mills are concentrated in Kolkata, Sodepur, Belgharia, Shyamnagar, Ghusuri, Salkia, Shrirampur, and Maurigram etc.

Problems associated with the cotton textile industry:

1. Long staple cotton is not well grown in many parts of India
2. Old machinery
3. High cost of advanced machinery
4. The high cost of production
5. Heavy competition from synthetic fibers like polyester, etc.
6. Huge competition in the world trade from Japan, China, Bangladesh, and UK, etc.
7. Poor modernization of cotton industry
8. Lack of capital
9. Problems of skilled and unskilled lobours
10. Poor supply of electricity and inadequate water availability

The old plant and machinery have to be replaced and introduction of the modernized machinery, easy loan facility, assured availability of raw-materials, labour, and power would ensure balanced growth of cotton industry in India.

JUTE TEXTILE:

Jute industry is an important and organized industry of India. More than 3 lakh direct and 4 lakh indirect employments are generated by jute industry in India. Jute Products have an important place in exported goods from India and country earns crores of rupees of income yearly and the value increasing continuously. In India jute is known as 'Golden Fiber'. Earlier very few products were manufactured from jute but presently a good range of products like coloured curtains, mats, blankets, water proof clothes are manufactured from jute. Jute industry is an ancient industry of India, developed as cottage and household industry in eastern India. The first attempt to modernized jute mill was done by George Oakland at the bank of Hugli River at Rishra in 1855. In 1859 Borneo Jute Company was setup by George Henderson, till 1900 there were 36 jute mills in the region. Both the two world wars created huge demand of jute products. At that time more than 3 lakh workers were engaged directly or indirectly in jute industry and in 1947, 110 jute mills and 68 thousand looms were in the country. But the division of country proved a great setback to the jute industry as major jute producing area about ($2/3^{rd}$) was now in Bangla Desh (Eastern Pakistan) and 102 jute mills were in India.

In 1949 Central Jute Committee was formed. Different five years plans were also supported jute industry a lot. Presently, more than 114 jute mills are in India and among them 6 are under the ownership of National Jute Production Nigam. Jute mills are mainly concentrated in the states of West Bengal; and state hold the monopoly in jute production. Other jute producing states are Uttar Pradesh, Andhra Pradesh, Chhattisgarh, Orissa, Bihar and Assam. In the year 2004-05, about 1615.4 thousands metric tons jute were produced in India. India export jute and jute products to USA, UK, Australia, Canada and many African countries. Jute industry

of India is facing several problems like heavy competition from China and Bangladesh. Old and traditional and inefficient jute mills, decreasing demands of cabas, bags and jute products, use of manmade fibers etc. are other major problems.

SUGAR INDUSTRY:

Sugar is a daily need commodity in each and every Indian house. India is the world's largest producer of sugarcane and second largest producer of sugar after Cuba. Sugar is produced mainly from sugarcane, and sugar-beet. But in India, sugarcane is the main source of sugar. At present, sugar industry is the second largest agro-based industry of India only after cotton textile industry. If 'gur' and 'khandsari' are also included then India becomes the largest producer. Industry involves a total capital investment of about Rs. 1,250 crore and provides employment to 2.86 lakh workers and about 2.50 crore sugarcane farmers also get benefit from sugar industry. India is rightly called the homeland of sugar and has a long tradition of manufacturing sugar from very past. References of sugar making are found even in the 'Atharva Veda' in the form of 'gur' and 'khandsari'. But modem sugar industry came into existence in India only in the middle of the 19th century, and was introduced by the Dutch in the North Bihar in about 1840, unfortunately, attempt was failed. The first successful attempt was made by the indigo planters at the initiative of Britishers in 1903. In 2009-10 about 744 sugar production plants were in the country.

Sugar industry in India is based mainly on sugarcane. Sugarcane is a heavy, low value, weight losing and perishable raw material and cannot be stored for a long time and also cannot be transported over long distances because increased transportation cost would raise the cost of production and the sugarcane may get dry up on the way. Normally, about 100 tonnes of sugarcane is required to produce about 10-12 tonnes of sugar. Therefore, the sugar industries in India are established and concentrated in the areas of sugarcane cultivation. It is clear that sugar industry has two major areas of concentration in India; one comprises Uttar Pradesh, Bihar, Haryana and Punjab region in the north and the other region is that of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in the south.

Regional Distribution of sugar industries:

Firstly in India, sugar industry was developed in Northern states like Uttar Pradesh and Bihar due to various advantages like fertile alluvial soil, extensive plane surface, and lower amount of irrigation, cheap irrigation and coal from Jharkhand and Chhattisgarh and thermal power from Rihand project, Dense population cheap lobours and developed transport network is also helpful in location of these industries in north. Bagasse from sugarcane also used as fuel. But production of sugar cane is lower as compare to southern states. Southern states on the other side have the advantages of favorable climate, black lava soil, and long duration of crushing and higher contents of sucrose. Major sugar industries are concentrated in the following states of India are:

Uttar Pradesh:

Uttar Pradesh is the traditional producer of sugarcane and sugar; presently occupies the second rank among the major sugar producing states in India. Uttar Pradesh has more sugar mills than Maharashtra but they are of comparatively smaller size and yield less production. Here more than 100 sugar plants are located. There are two different regions of sugar production in Uttar Pradesh. One region is Basti, Gorakhpur, Gonda, and Deoria in eastern Uttar Pradesh and the other lies in the upper Ganga Plain of western Uttar Pradesh consisting of Saharanpur, Shamli, Deoband, Bulandshahar, Muzaffarnagar, Bijnore, Meerut, and Moradabad. Presently, state accounts for about 24 per cent of the total production of sugar in India.

Maharashtra:

Maharashtra is presently the largest producer of sugar in India. Huge production of sugarcane, higher rate of recovery and longer crushing period are some of the factors which have helped the state to occupy this enviable position. The major concentration of sugar mills in Maharashtra is found in the river valleys in the western part of the Maharashtra Plateau. Ahmednagar is the largest centre. The other major centres are in the districts of Kolhapur, Solapur, Satara, Pune and Nashik etc.

Tamil Nadu:

Tamil Nadu has shown phenomenal progress with regard to sugar production in India during the last few years. Positive conditions like favourable climate, high per hectare production of sugarcane, higher sucrose content, high recovery rate and long crushing season have enabled Tamil Nadu to develop its sugar industry at fullest. State has set the mark of highest yield of 9.53 tonnes of sugar per hectare in the whole of India. Most of sugar mills of the state are located in the Coimbatore, North Arcot Ambedkar, South Arcot Vallalur and Tiruchchirapalli.

Karnataka:

Karnataka has more than 30 mills producing about 1,151 thousand tonnes i.e., more than 6 per cent of the total sugar of India. Belgaum and Mandya districts of Karnataka have the highest concentration of sugar mills. Bijapur, Bellary, Shimoga and Chittradurga are the other districts where sugar mills are scattered.

Andhra Pradesh:

Andhra Pradesh has more mills than the neighboring state of Karnataka but produces only 6.01 per cent of India's sugar. The sugar mills of Andhra Pradesh are comparatively smaller. Majority of the sugar mills are concentrated in East and West Godavari, Krishna, Vishakhapatnam, Nizamabad, Medak and Chittoor districts.

Besides these, sugar is produced in the states of Gujarat, Haryana, Bihar, etc. In Gujarat 16 mills are scattered in the districts of Surat, Bhavnagar, Amreli, Banaskantha, Junagarh, Rajkot and Jamnagar districts. The state produces about 5.56 per cent of the total sugar produced in India. Haryana has only 8 mills located in Rohtak, Ambala, Panipat, Sonipat, Kamal, Faridabad and Hissar districts. Punjab has a total of 13 mills which are located in Amritsar, Jalandhar, Gurdaspur, Sangrur, Patiala and Rupnagar districts. Bihar was the second largest sugar producing state, next to Uttar Pradesh till mid- 1960s. But presently state has been experiencing sluggish growth. Its 28 mills are spread in the districts of Darbhanga, Saran, Champaran and Muzaffarpur, etc. Madhya Pradesh (8 mills in Morena, Gwalior and Shivpuri districts), Rajasthan (5 mills in Ganganagar, Udaipur, Chittaurgarh and Bundi districts), Kerala, Orissa, West Bengal and Assam are the other sugar producer states.

Problems of Sugar Industry:

Sugar industry in India is facing severe and complicated problems which need abrupt attention and coherent solutions. Some of the burning problems of sugar industry in India are briefly described as under:

1. Per hectare low yield of sugarcane

2. Short crushing season

3. Unstable production trends

4. Low recovery rate

5. Competition with the ‘Khandsari’ and ‘Gur’ making

6. Regional imbalances in distribution of sugar industry

7. Low per capita consumption of sugar

8. High production cost

9. Small and uneconomic size of mills

10. Old and obsolete machinery

11. Poor water and power supply

12. Labour problems

13. Import of sugar by Indian government

14. Huge debts on sugar mills

15. Poor quality of sugarcane

16. Lack of storage, and transportation facilities

17. Poor and delayed payments to the farmers

(C) Forest Based Industries

India is one among few fastest growing forest-based industries in the world. Forests provide us different types of raw materials which are used in forest based industries. For instance, paper industry, match industry, plywood, furniture, silk industry, lack industry, rayon, resin, leather tanning, sports goods and handicraft industry are some forest based industries.

PAPER INDUSTRY

Paper is one among few daily used products. Use of paper is considered as an important indicator of development of any country. Per person use of paper in India is very low (only 7 kg/person) as compared to world average which is about 50 kg per person. The first effort to produce paper by modern techniques was done in 1812 when a paper mill was established in Serampur of West Bengal. In 1870 Bally Paper Mill was established near Kolkata. The first successful paper mill was set up in 1879 in Lucknow. Again, in 1882, paper mill was set up in Titagarh in West Bengal. Till 1900 there were 7 paper mills in India.

After independence India witnessed a huge development in paper industry. Paper industry is a weight losing industry and about two and half tonnes raw materials are needed for making one tone of paper. The localization of this industry is seen mainly in the areas of raw materials. The main factors that favour the location of the paper industry are the availability of raw materials like soft wood, bamboo, bagasse, rags; various chemicals are also required. Power and adequate supply of soft and clean water and nearness to centers of consumption are important for paper and cardboard industry. India has very little softwood; it depends largely on bamboo, sabai grass, bagasse, straw, waste paper and salal wood. Bamboo is mostly used raw material for making paper in India and about 70% raw material for paper industry is obtained from bamboo. Karnataka, and Assam are the major producers of bamboo, sabai grass provides 15% raw material and Madhya Pradesh, Maharashtra, Andhra Pradesh and Orissa are the major sabai grass producing states. Bagasse, an important raw material of paper industry, is a sugarcane residue provides 7% pulp for paper industry mainly industrial paper, hard board paper, packing paper etc. are made from it. Besides this, paper pulp is also made from wastepaper and rags. It is used to make handmade paper. India is the leading producer of handmade paper and also a big exporter of handmade paper.

Besides all these straw of paddy, wheat and maize are also used in making of paper. Presently India have more than 700 paper and pulp mills which are producing 58 lakh tonnes of paper and cardboard and 7.7 lakh tonnes of newsprint but the production potentials are much higher. West Bengal, Andhra Pradesh, Maharashtra, Karnataka, Madhya Pradesh, and Uttar

Pradesh are the leading producer of paper and cardboard in India. Besides these Taminnadu, Bihar, Haryana and Assam also produce paper and cardboard in significant amount.

NEWSPRINT:

Newsprint production was started by National Newsprint and Paper Mills (NEPA Ltd.) in 1955 at Nepanagar in Madhya Pradesh. Till 1981, it was the only mill in the country manufacturing the newsprint. From 1981-1987, three more newsprint mills were set up at Mysore in Karnataka, Nellore of Andhra Pradesh, and Pugalure inTamil Nadu. There are about 26 newsprint mills in the India. Among them four large public sector mills namely, National Newsprint and Paper Mills Ltd (NEPA Ltd.), Nepanagar, Madhya Pradesh, Hindustan Newsprint Ltd. (HNL) Kottayam Kerala; Mysore Paper Mills Ltd (MPML), Bhadravati (Karnataka); and Tamil Nadu Newsprint and Paper Ltd. (TNPL) in Kagithapuram of Tamil Nadu are important to mention here.

PROBLEMS OF PAPER INDUSTRY:

There are various problems linked with the paper industry in India. The most serious is the problem of lack of raw material for producing good quality paper and newsprint. Many of the chemicals used by the industry have to be imported. The problem of power shortage is also there with some mills. Several types of assistance have been provided by the government to this industry and it is still fulfilled through import of both paper and pulp.

LAC INDUSTRY:

Lac is used in manufacturing of polish, gramophone records, wood turning, printing ink, paints and varnishes, photographic equipment, bangles, toys and in enameling, as insulating agent and in adhesives. Lac is obtained from an insect named *Cerria Lacca* which secretes a resin and cultivated mainly in India and Thailand. Lac insect lives on trees like pipal, palash, babool, kusum etc. Lac is an important forest product of India. Till 1950, India had most probably monopoly in the production of lac in the world but slowly its position has declined. Lac in India is produced mainly in Madhya Pradesh, Jharkhand, Chhattisgarh, Meghalaya, Asasm, Orissa, Uttar Pradesh and West Bengal etc. Chotanagpur Plateau is the biggest lac producing region of the India and more than 80% lac produced in India is exported. India is exporter of lac and lac products to USA, Russia, UK, Germany, Italy, Japan, Sweden, Australia, Brazil and France etc. India is a leading country in lac production and 60% of lac in the world is produced here.

RUBBER INDUSTRY:

Rubber is obtained naturally, synthetically and from reclaimed rubber and a range of goods are manufactured from them. Rubber is gaining increasing importance in every aspect of life. At present life of peoples are heavily depending on rubber and rubber goods. The beginning

of the rubber industry is traced back to the year 1920 when a rubber goods factory named Dixie Aye Rubber Factory was started in Kolkata. Later on in 1933, Bata Shoe Company and in 1935 Dunlop Rubber Company was started.

The major rubber goods produced by the industry are tyres and tubes of automobiles from heavy trucks to bicycles, surgical gloves, sports goods, footwear, cots, aprons etc. Total production of natural rubber was 774,000 tonnes and average yield was 1,443 tonnes/ hectare in 2014-15. India imports a huge amount of rubber; import of rubber was 442,130 tonnes in 2014-15. Consumption of rubber is very high in India due to the growing automobile and domestic uses of rubber. The development of automobile industry has considerably increased the demand for tyres and tubes in the country. Natural rubber is found in mainly three states of Kerala, Karnataka and Tamil Nadu. Main centers of rubber industry are Kolkata, Hawarah, Mambai, Shahaganj, Thiruvannathpuram etc. The role of synthetic rubber has increased with the increase in demand of natural rubber. The first synthetic rubber factory was started in Bareilly in 1955. Export of rubber goods is also increasing continuously; UK, Czech Republic, Iraq, Sudan, Korea, are the importer of automobiles tyres whereas USA, Russia, Canada, Middle east purchase rubber footwear. And Afghanistan, Ghana, Greece, Romania, Italy import bicycle tyres from India.

LEATHER AND TANNING INDUSTRY:

India has a long tradition of manufacturing leather and leather goods. India was famous for its leather goods from Vedic period. Tanning of leather is very important part of leather industry. The word 'tanning' is generally refers to a variety of processes collectively which change skins and hides into processed leather. India holds first position in livestock in the world thus has a large availability of skins and hides. Industry is running both under organized and unorganized sectors providing employment more than 2.5 million peoples. Leather industry occupies an important place in respect of foreign exchange earnings and employment generation in India. Role of small, cottage, household and artisans are more important in tanning industry as about 72% of the total production comes from them. The first tannary in India established in 1867 in Kanpur to fulfill the military demands. At the time of independence, there were about 32 organized tanneries in India. Tanning of hides and skins and manufacturing of leather goods is concentrated in Kolkata, Agra, Kanpur, Mumbai, Chennai, Coimbatore, Bangalore, Kapurthala, Bhopal, Tonk, Tiruchchirappalli, and Perambur etc. Tamil Nadu has the largest concentration of tanning industries in India.

Leather is used for manufacturing garments, footwears, suitcases, bags, etc. Export from the leather sector today account for around four percent of India's export. Russia, USA, UK, Japan, Italy, Germany, France, Canada and Yugoslavia are buyers of Indian leather and leather goods. Presently industry is facing sever environmental problems and due to courts intervention many small scale industries are at the closing stage as they are not capable of to follow and fulfill the norms of the environment protection laws.

MATCH INDUSTRY

Match industry in India is important industry because it deals with everyday needs and also is good earner of revenue for the government. Match production in India is done in both modern factories and at cottage and house hold levels. The first match factory in India was established in 1921 in Ahmadabad. The Western India Match Company (WIMCO) came into existence in 1923; it started five factories at Bareilly, Kolkata, Chennai, Ambarnath in Mumbai and in Dhubri of Assam. About 30 per cent match is produced in India by small scale units and cottage industries and rest by the factories of WIMCO along with Assam Match Co. (AMCO.) i.e. about 70%. There are about one thousand small scale units of match manufacturing.

The matchstick is made by a special kind of soft wood. The woods of the trees called dhoop, didhu, bakota, poplart, salai, mango, semal, sundari etc. is especially used for it. The phosphorus and various other chemicals as paraffin, potash, are still imported. Match factory requires cheap and skilled labour because one-third of the cost of manufacturing match is on labour. This is most localized industry of South India and Maharashtra; Pune, Chinglepet, Tirunelveli, Ramanathpuram, Kolkata, Mumbai, Chandrapur, Thane, Hyderabad, Dhubri, Bilaspur, Jabalpur, Kota, Ahmadabad and Bareilly, Meerut, are the main centre of match production in India

SILK INDUSTRY:

There are two stages in silk industry one is sericulture and obtaining of silk fibers and another one is processing of silk to produce silk textile from silk fibers. Sericulture is completely forest based industry. Sericulture is done mainly on the mulberry trees but the trees like, oak, mahua, castor, sal, plum, kusum etc. are also used for silk worm rearing. More than half of the total silk production in the country is done only in Karnataka. Other major silk producing states are West Bengal, Jharkhand, Jammu & Kashmir, Orissa, Madhya Pradesh etc. Several kinds of silk are produced in India for instance:

Mulberry silk: This is the silk made obtained by sericulture on mulberry trees. This is the best kind of silk and 85% of the silk produced in the India is mulberry silk. It is produced in the states like Karnataka (mainly in Bengaluru, Mysore, Kolar and Tumkur districts), West Bengal (Bankura, Murshidabad, Midnapur and Burdwan districts), Assam and Jammu & Kashmir.

Muga silk: This silk is also produced by sericulture done on the mulberry trees and produced mostly done in Assam, West Bengal and Jammu & Kashmir states.

Tasar silk: It is produced by sericulture done on the wild mulberry trees. The major tasar silk producing states are Jharkhand, Orissa and Madhya Pradesh.

Eri silk: It is produced by rearing silk worm done on the leaves of castor and a low quality silk.

Silk Textile Industry: It is indirectly a forest based industry. Silk industry is localized either in the centres of raw material or in the place of demand and or in some industrial cluster. Karnataka is the largest producer of silk fibers in India. About half of the silk fibers in the country are produced by Karnataka alone. Other importnat centers of silk industry are Mysore, Bengaluru, Coimbatore and Srinagar, Varanasi, Tirupati, Madurai, Kanjivaram, Bhagalpur (Bihar), Chennai and Mumbai.

BEEDI INDUSTRY:

The beedi making industry has developed mainly in tribal regions. This industry is purely baesd on the forest tree leaves known as 'Tendu'. Madhya Pradesh is the largest producer of beedi because the 'tendu' leaves are found mostly in the forests of this state.

Besides above mentioned industries, several industries related to sandalwood in Karnataka and eucalyptus in Tamil Nadu has developed. The woodcraft industry has developed in Karnataka, Himachal Pradesh and Jammu and Kashmir. Copra (coconut and its fibres) industry (undertaken by the Coconut Board of India) has developed in Kerala.

RAYON INDUSTRY:

Rayon is a manufactured i.e. manmade fiber made from regenerated cellulose fiber. Manmade fibers like rayon are an essential part of textile industry in India. The many types and grades of rayon are produced for making textile in India. Their feel and texture are just like natural fibers such as silk, wool, cotton, and linen etc. Rayon is made from purified cellulose, primarily from wood pulp which is obtained from bamboo and eucalyptus and is converted chemically into a soluble compound. This compound is dissolved and changed into fibers of cellulose. The fibers can be easily dyed in a wide range of colors. Rayon fabrics are very soft, and comfortable thus are in great demand. Till 1935 rayon industry was based on imported fibers. But first indigenous rayon manufacturing mill was established in Travancore of Kerala in 1945 and production started from 1950. After that various rayon industries were established in Mumbai, Hyderabad, and Madhya Pradesh. Presently more than 50 mills are making synthetic fibers and providing yarns to lakhs of power looms and hand looms in India. Largest concentration of rayon industry can be seen in the states of Maharashtra, Uttar Pradesh, Gujarat, West Bengal, Tamil Nadu and Delhi etc. Shortage of raw materials, lack of adequate machinery, labour, and chemicals used, old and traditional machinery, adequate power and water supply are the major problems associated with Indian rayon industry.

RESIN INDUSTRY:

Resin is a sticky, flammable organic substance, generally insoluble in water, obtained by some trees and other plants for instance from fir and pine. A solid or liquid synthetic organic polymer used as the basis of plastics, adhesives, varnishes, or other products.

(D) HOUSEHOLD INDUSTRY

Household industries are those industries mainly run by the head of the family or with the help of the family members at home or within the village in rural areas. These industries are mainly run as unregistered.

The main norm of a household industry is the participation of one or more members of a family. This criterion applied in urban areas too. There is greater possibility of the members of the family to help in the industry. A household industry is one that is engaged in production, processing, servicing, repairing or making and selling of produced goods. Actually no or very poor mechanization is associated with household industries.

(E) ENGINEERING INDUSTRY

Engineering Industry is concerned with the production of a wide range of heavy and light machines and its associated products. They produce machines, engines of automobiles, tractors, harvesters, and other agricultural and mining machines, etc. Engineering industries can be classified into various types depending upon the shape and size of the products, amount of raw materials used and capital invested, and also number of labours engaged in them. There are three main types of engineering industries developed in India are as follows: Heavy Mechanical Engineering Industry, Light Mechanical Engineering Industry, Electrical Engineering Industry.

Engineering industry makes base for the industrialization of any country. The Indian engineering industrial sector is witnessing an extraordinary growth from last few years. The Indian engineering sector is of strategic importance to the Indian economy owing to its intense integration with other industrial segments. The sector has been de-licensed and enjoys 100 per cent FDI. India exports different transport equipments, capital goods, other machinery and equipment and light engineering products such as castings, forgings and fasteners to various countries of the world. Export of engineering goods from India was of Rs. 198 crore in 1970-71 which increased to 433868 crore in 2014-15. But various problems like lack of raw materials, lack of capital, heavy rent, higher competitions, lack of quality control and poor domestic demands are also associated with engineering industries in India. To solve these problems government should provide subsidies, easy means of capital should develop, and measures of quality control are must.

(F) Other Demand-Based Industries

All the industries which cater the needs of the population from daily goods to heavily mechanized goods and services are included in the group of demand based industries.

12.4 SUMMARY

In ancient period India was a developed industrial setup and major production was done in the form of household, cottage and artisan basis. India clothes like muslin, cotton and silk, crafts, artistic wares, were famous and in great demand in the world. But the rule of British and industrial revolution were the hazard for cottage and small scale industries of India. These led to the decay of traditional artisans and handicrafts. Wrong policies of British rulers degraded the Indian small industries. New era of industrial development started only after the independence of India. Various goals oriented five year plans had provided necessary base of capital, technology, decisions making, execution and co-operation to the industrial rise of India. Presently industries are playing an important role in the development of the country. Industries are providing huge employment to the population of India, higher income, changing the face of Indian economy, facilitating trade and commerce, earning valuable foreign exchange, and strengthening economy. The economy of India is developing as mixed economy and is the world's sixth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP). After 1991 economic liberalization, India achieved 6-7% average GDP growth annually. India's economy is among few fastest growing economies of the world. Future growth prospective of the Indian economy is very optimistic due to its young population, increasing demands of goods and services.

IT industry, the rising sector of Indian industries, is the largest private-sector employer in India. Industrial sector has stable shares in economic contribution about 26% of GDP in 2013–14. Automobile, e-commerce, health industry, IT industry and BPO, and tourism are growing sectors of Indian economy.

Industrial development is presently considered as the base and prerequisite of modern economic development of the countries. Countries throughout the world are developing its industries and exploring the resource base of theirs. Rapid resource utilization, economic development, upgrading the living standards of populations, and taking benefits of the globalizations are the major goals of the countries. Countries are considered power full and developed those who have developed industries of all kind for instance iron and steel industry, heavy machinery making, automobile industry, chemical and fertilizer industry, oil and allied products production, artillery production, cement industry, drugs and rubber industry etc. are providing a sense of development to the countries. Recently information technology industry, tourism industry, health industry, education industry and entertainment industry have developing rapidly with the changing cultural, economic and demand aspects of the world’s populations. There are various more aspects are waiting to be explored.

12.5 GLOSSARY

BPO- Business Process outsourcing

Industry- An economic activity which is concerned with the processing of raw materials and manufacturing of goods

Economy-An economy is the large set of inter-related production and consumption activities that facilitate careful resources management

Mixed economy- An economic system of combined private and state ventures

Socialist Economy- Socialist economy means the system where economic system is controlled and regulated by the government so as to ensure public welfare

PPP- Purchasing power parity

IT- Information Technology

USD- United States Dollar

FDI- Foreign direct investment

Globalization- the process by which businesses or other organizations start operating on an international scale

Liberalization- process whereby a state lifts its restrictions and regulations on private individual activities

Hydel-power- energy generated by the transfer of free-falling water energy to electricity

Industry- an economic activity that is concerned with the production of goods

E-commerce- online buying or selling of products

12.6 ANSWER TO CHECK YOUR PROGRESS

1. Industry refers to an economic activity that is concerned with the production of goods, extraction of minerals or to provide the services.

2. Industries use raw material obtained from agriculture for processing are known as agro-based industries.

3. Bauxite is the major are used in aluminum industry.

4. TISCO was established by Jamshed ji Tata.

5. SAIL was established in 1974.

6. Aluminum was discovered in 1886.

7. ATC was come into existence in 1937.

8. Frist cotton textile industry in India was established in the year 1818 at Fort Gloster.

9. Nepanagar is famous for Newsprint.

10. Lac is obtained from cerria Lacca insect.

11. Four type of Silks are produced in India.

12. Leaves of Tendu plant are used in Bidi industry.

13. Cottage Industry run by the family head or by the members of the family in home.

14. e-commerce, health industry, IT industry, BPO, and tourism are growing sectors of Indian economy.

12.7 REFERENCES

1. Arnold, David. (2004). *The New Cambridge History of India: Science, Technology and Medicine in Colonial India*, Cambridge University Press.

2. Balasubramaniam, R. (2002). *Delhi Iron Pillar: New Insights*, Indian Institute of Advanced Studies.

3. Gommans, Jos J. L. (2002). *Mughal Warfare: Indian Frontiers and Highroads to Empire, 1500-1700*, Rutledge.

4. Mamoria, Chaturbhuj. (1992): "Adhunik Bharat ka Brihat Bhoogol", Sahitya Bhavan, Agra.

5. Ojha, S.S. "Bharat ka Bhoogol". (2005): Bhaugolik Adhyan Sansthan, Govindpur, Allahabad.

6. Rakesh Tewari, 2003, *The origins of iron-working in India: new evidence from the Central Ganga Plain and the Eastern Vindhyas.*

7. Srinivasan, S. & Ranganathan, S., *Wootz Steel: An Advanced Material of the Ancient World*, Indian Institute of Science.

8. Tiwari, R.C. (2003):"Geography of India", Prayag Pustak Bhawan, Allahabad.

9. Agriculture Survey of India, 2017-18.

10. Economic Survey of India (vol.1st and 2nd). Oxford University Press, New Delhi.

11. Gopalakrishnan, R. "Geography of India", Jawahar Publishers.

12. Indian Budget, 2017-18.

13. Industrial Survey of India, 2107-18.

14. Sen Gupta, P. (1968). Economic Regionalization of India, Census of India Publication.

15. Singh, Jagdish. (2003). "India: A Comprehensive Systematic Geography", Gyanodaya Prakashan, Gorakhapur.

16. Singh, L.R. (ed.). (1987): "India: A Regional Geography", New Printindia Pvt. Ltd., Ghaziabad, U.P.

12.8 TERMINAL QUESTIONS

(a) Long Questions

1. What do you understand by industry? Explain major types of industries with examples?

2. Describe Iron and steel industry of India in detail with problems prevailed and solutions?

3. What do you mean by agro-based industry? Explain two of them?

4. What are the major forests based industries? Write notes on three of them?

5. Explain cement industry of India with their distribution, problems and solutions?

(b) Short Questions

1. What do you mean by industry?

2. What do you mean by agro-based industries?

3. Name the major ore used in aluminum industry?

4. Who established TISCO?

5. When SAIL was established?

6. In which year aluminum was discovered?

7. In Which year AIC was came into existence?

8. When and where first cotton textile industry in India was established?

9. Why Nepanagar is famous for?

10. Name the insect from which lac is obtained from?

11. How many type of silk is produced in India?

12. Name the plant whose leaves are used in bidi industry?

13. What do you mean by cottage industry?

14. Name few rising sector of Indian industry?

(c)-Multiple choice questions

Q-1 Raw material based industries include?

1- Agro industries

2- Wooden Industries

3- Ocean basis industries

4- all of the above

Answer- 4

Q-2 Industries are divided on the basis of size.

1- 2

2- 4

3- 6

4- 8

Answer- 1

Q-3 Includes division of industries on the basis of ownership.

1- Private Sector

2- State Owned Public

3-Joint Industries

4- All of the above

Answer- 4

Q-4 When and who established the modern iron industry.

1-1907 Jamsd ji Tata

2-1954 Dawer ji Kavas

3- 1919 IISCO

4- None of the Above

Answer - 1

Q-5 These are the major problems of the iron and steel industry.

1-Procurement of quality raw materials

2-lack water supply

3- Lack of power supply

4- all of the above

Answer - 4

Q-6 When was the production of aluminum started for the first time in India?

1- ACI 1937

2-TISCO 1907

3-IISCO 1919

4- all of the above

Answer 1

Q-7 full form of NHB...

1- National Housing Bank

2-New House Bank

3- Nuclear House Board

4-None of the Above

Answer- 1

Q-8 Agro based industry is....

1- Cotton

2- Textile, Jute

3- Sugarcane

4- all of the above

Answer-4

Q-9 The first cotton industry was established in India.

1- 1818

2- 1854

3- 1860

4- 1994

Answer - 2

Q-10 What are the main problems of jute industry?

1- Old machine

2- The high cost of production

3- Lack of Capital

4- all of the above

Answer - 4

Q- 11 It is the largest Jute producing state in India.

1- Uttar Pradesh

2- Maharashtra

3-Andhra Pradesh

4-Uttarakhand

Answer -1

UNIT 13 KASHMIR REGION AND UTTARAKHAND HIMALAYAS

13.1 OBJECTIVES

After having the detailed study of this unit you will be able to-

- Know detail the physiographic divisions of Kashmir region.
- Know in detail the physiographic divisions of Uttarakhand Himalayas.
- Understand in brief the socio-economic conditions of Kashmir region and Uttarakhand Himalayas.
- Discuss the problem, prospects and significance of Kashmir and Uttarakhand Himalayas

13.2 INTRODUCTION

Physiography deals with the study of the surface features and landforms of the earth. In the given unit detailed study of Kashmir region and Uttarakhand Himalayas is done. Description comprises of both physiographic division as well as socio-economic conditions. Unit starts with the formulation of few objectives as mentioned above. According to these objectives the study is conducted. Firstly the India is divided into five physiographic divisions: 1) The Himlayan Mountains Complex, 2) The Indus-Ganga-Brhamputra Plain, 3) The Peninsular Plateau, 4) The Coastal Plains and 5) The Islandsand then detailed study is done of Kashmir region and Uttarakhand Himalayas. For detailed study of physiographic division of Kashmir region; it is divided into six divisions, Outer Plains, Shiwalik, Lower Middle Himalayas, Valley of Kashmir, Greater Himalayas, Laddakh Plateau with suitable diagram. Further brief description is also done of climate, rivers, vegetation, wildlife and socio-economic life of Kashmir Region. In the same manner the detailed study of physiographic division with suitable diagrams is done of Uttarakahnd Himalayas. Uttarakhand Himalayas are divided into four dividons: 1) Trans Himalayas, 2) Great Himlayas, 3) Lesser Himlayas and 4) The Shiwaliks. Furhter more the brief study of drainage system, lakes, soil, climate and Scio-economic study of Uttarakahnd Himalayas is also done. A short Summary of Kashmir Region and Uttarakhand Himalayas is cited at the end of the detailed study. After the short summary, Glossary and References are also cited and finally unit ends with some terminal questions.

13.3DETAILED STUDY OF KASHMIR REGION, UTTRAKHAND REGION

It is quite natural that a vast country like India should have a great diversity of relief features. The physiographic diversity of India embraces lofty young fold mountains, flat plains and one of the oldest plateaus of the world. Physiography deals with the study of the surface features and landforms of the earth. On the basis of tectonic history, stratigraphy and physiography, India may be divided into the following four physiographic divisions as (Khullar 2003):

1. The Himalayan Mountains Complex
2. The Indus-Genga-Brhamputra Plain
3. The Peninsular Plateau
4. The Coasts and the Islands

Fig: 13.1 IndiaPhysiography

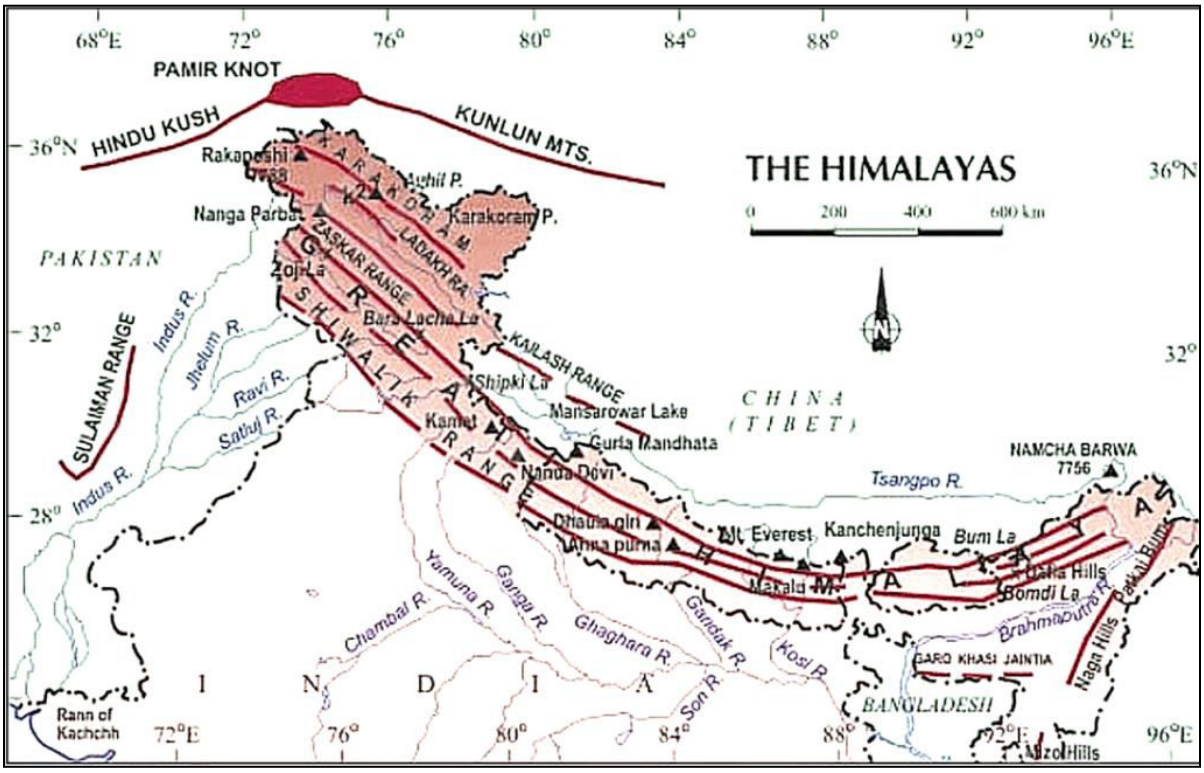
Source: Google Images

13.3.1 PHYSIOGRAPHIC DIVISIONS OF HIMALAYAS

For a systematic study of the physiography and relief, the Himalayas may be divided into the following four divisions from north to south (Majid Hussain 2008):

1. The Trans-Himalayas
2. The Greater Himalayas
3. The lesser Himalayas and
4. The shiwaliks or the Outer Himalayas

Fig: 13.2 Himalaya



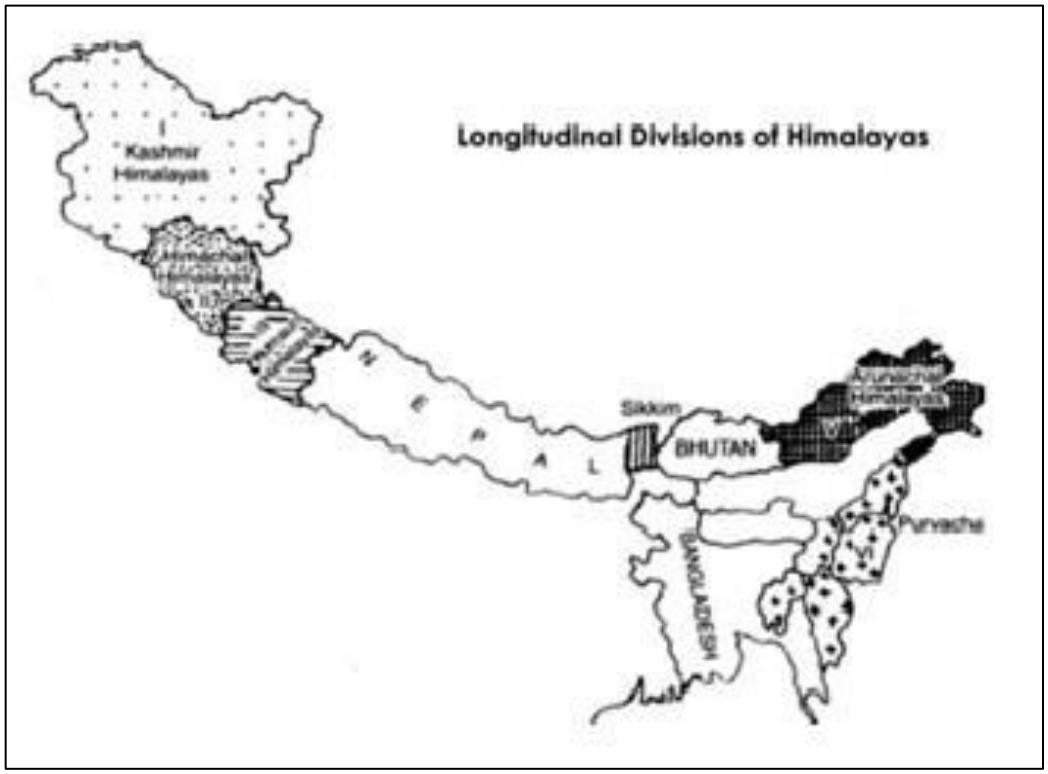
Source: Goggle Images

13.3.2 LONGITUDINAL DIVISIONS OF THE HIMALAYAS

The Himlayas has also been disvided by Sir S. Burrard into four divisions, namely (i) The Western Himlayas, (ii) The Kumaun Himalayas, (iii) The Nepal Himalayas, (iv) The Assam Himlyas. Prof. S. P. Chatterjee (1973), divided the Himalayas into the following five transverse divisions from west to east:

1. The Kashmir Himalayas
2. The Himachal Himalayas
3. The Kumaun Himalayas
4. The Central Himalayas
5. The Eastern Himalayas

Fig: 13.3 Division of India



Source: Google Images

13.3.3 DETAILED STUDY OF KASHMIR REGION

Kashmir have unusual geo-physical setting as all the major landforms i.e. plateaus, plains, mountains and valleys are present here. It is situated between 32^0 17' to 36^0 58' north latitude and 37^0 26' to 80^0 30' east longitude. The state is divided into three natural divisions, namely Jammu, Kahmir and Ladakh.

Jammu Region: It is situated in the north Indian plains, close to Shiwalik ranges. It is 305 mts above the mean sea level. Pir Panjal range separates the Jammu and Kashmir region. Jammu region is drained by Chenab River. It has districts like Kathua, Jammu, Udhampur, Rajouri etc.

Kashmir Region:The average elevation is 1630 mts above mean sea level. The region is famous for the picturesque natural beauty. Dal lake and Wular lake are the largest fresh water lake in India. The valley is known for the apples, saffron, rice . It has districts like Anantnag, Baramulla, Pulwama, Srinagar etc.

Ladakh Region: Ladakh is the eastern most part of Jammu and Kashmir. It is one of the most breathtakingly beautiful parts of the state.It has two district Leh and Kargil. It is 3700 mts above the Mean Sea Level. Ladakha is on leeward side, sparsely populated, people live traditional life, herding sheep and yak and growing barley near the river bed. It has Indus river flowing right through Ladkakh.

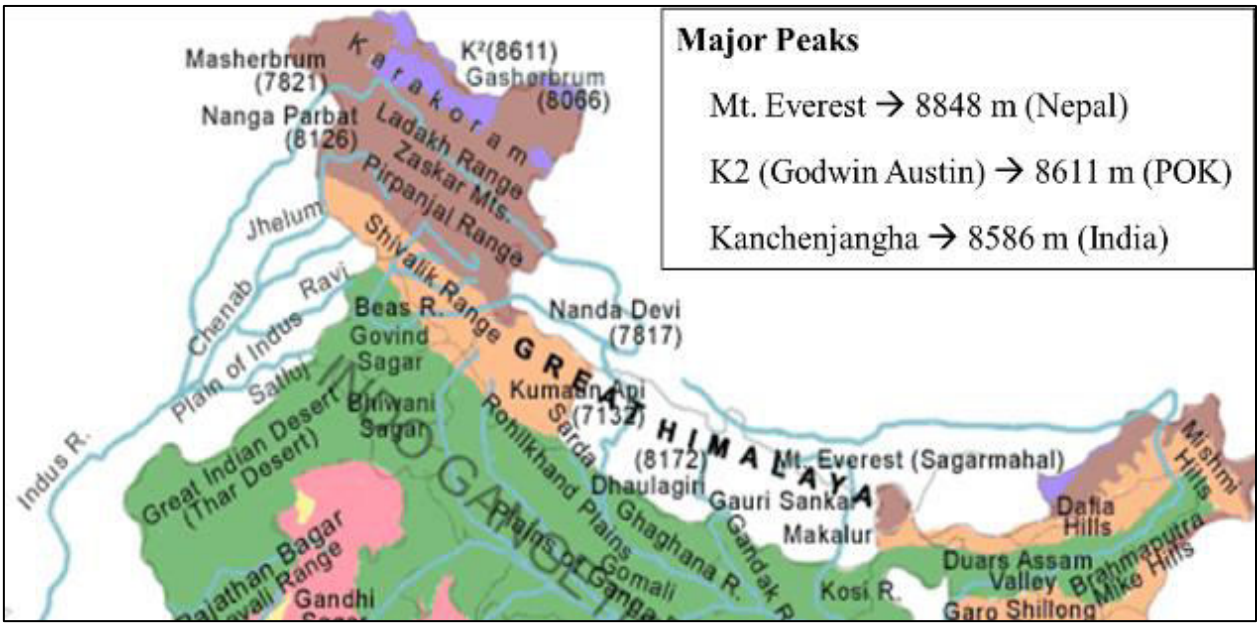
The physiography of the Kashmir is divided into six regions and these are mentioned below:

1. The outer Plains
2. The Shiwalik
3. The Lower Middle Himalayas
4. The Valley of Kashmir
5. The Greater Himalayas
6. The Plateau of Ladakh

1. The Outer Plains: The outer plain is locally known as Andharwah or Bajwat. The rocks of this region are fluviate and subaerial formation**.** Width varies from 5-25 kms stretches between river Ravi to river Chenab for about 110 kms. This region is also drained by rivers Tawi, Basantar, Ujh, Manawar Tawi. This plain has deep and shallow ravines which carry flood monsoonal water. Rainfall is low of 15 to 20 inches in a year in summer. These plains are highly fertile and crops mainly rice and wheat is grown due to their fertile soil. The denuded trees, thorn scrub and coarse grass are the dominant forms of vegetation. At higher elevation, hill slopes are full of wooded vegetation.

2. The Shiwalik: These are the youngest mountains of the Indian subcontinent made up of younger tertiary rocks. The shiwalik hills are situated to the north of the outer plains. Himalayas along its whole length from the Indus and Brahamputra are known as Shiwalik. Shiwalik are well developed between the river Ravi and Jhelum.

Fig:13.4 Major Peaks



Source: Google Map

The width of Shiwalik is 20 to 50 kms. and height above mean sea level is 600 to 1200 mts. The outermost ranges rises from Punjab plains, with gentle slope and attain height of 600 mts covered with deciduous forests and end abruptly in steep folded mountains with dense vegetation. The hills consist of sand, clay, round pebbles and boulders which are dissected by ravines and seasonal stream courses. The Shiwaliks look like as isolated and broken hills. The higher slopes are having pine forest. A series of wide longitudinal valleys lie to the north of Shiwalik known as dunes. Lower hills between Ravi and Chenab rivers known as Kandi, they have hilly soils and scarcity of water. Xerophytic vegetation is common in these areas. Lake Mansar and Sarunsar are found at 600 mts towards the east of Shiwalik. The important towns found in these shiwaliks are Samba, Akhnoor and Jasrota, Jammu etc.

Cultivation of millets, pulses, oilseeds, maize and fodder, rearing are the primary economic activities in Kandi region. Economically, this is the most underdeveloped region of the state. Gujjars are the buffalo- rearers and known as Doodhiya-Gijars. (Ojha, 2007a)

3. Lower Middle Himalayas: In Jammu region they are locally known as Pahar (mountains). They lie between Ravi in the east and the Punch in the west. The ranges of Pir Panjal and Dhauladhar lies in the middle Himalayas. In general they have east-west extension.

Elevation of middle Himalayas is 3600-4600 mts above mean sea level and width is 60 kms. They are compressed and altered rocks of various geological periods ranging from Carboniferous to Eocene. The area is poor in basic minerals resources in coal, petroleum and natural gas. Lower Himalaya are rich in clay, sands, building stone, slate, limestone and enormous water resources harnessed by hydel power. Middle Himalayas are also rich in metallic minerals like iron-ore, copper, bauxite, lead, silver and gold. There is a Trikuta mountain having south-west extension having the sacred cave Vaishno Devi. The ridges have steep escarpment towards plain and gentle slope towards Kashmir. They have 'orthoclinal' structure, with a writing desk. Several important rivers like Manawar-Tawi, Basantra, Tawi and Ujh have their sources in the middle Himalayas. Due to the presence of dense forest vegetation in the north and north-eastern slopes looks beautiful. Valley slopes are barren and devoid of snow, being too steep to maintain a soil-cap and allow the winter-snow to accumulate. The range has considerable rainfall in the form of snowfall and summer rain with extensive area of pastures above the tree line. The people are largely dependent on forestry lumbering, herding and tourist activity. Forest of Deodar, Pine, Fir are found here and mountains are crossed by Jammu-Srinagar National Highway. Banihal, Ramban, Doda, Batote and Rajori are the important towns (Ahir, 2007a).

4. **Valley of Kashmir**: Valley of Kashmir is nestled as a asymmetrical deep valley between the western end of great Himalayas and Pir Panjal range, characterized by snow covered lofty peaks. The surrounding mountais rising to a highet of 5550 mts and Banihal-pass (JawaharTunnel) is the only exit for the river Jhelum at the Baramulla-gorge. This valley has a length of 140 kms and width of 53-55 kms. The lowst point has an elevation of 1600 mts. Oval shape of valley is filled with thick deposits of alluvium these are known as Karewas.

Within the Kashmir Valley there are three more valleys namely: The Lidder valley, The Sind Valley and The Lolab Valley.

a) **Liddar Valley:**Lidder valley streatches from Anantnag (Islamabad) to Pahalgam. Its length is 64 kms. And have glaciers, grassy meadows, huge rock walls and gorges in its upper mountains. At Pahalagm the Liddar River is divided into two parts; one is leading uptoSheshang and the caves of Amarnath and other uptoKolahai. Kolhai is the small valley covered with grasses where glades are used by graziers.

b) **Sind Valley:** Sind valley is the largest tributary of Jhelum. Sind valley is 100 kms long and its scenery is diversified. It extends from Ganderbal to Zojilla Pass which leads to Ladakh. Sonamarg (golden meadows) is a beautiful meadow near the Thajwas Glacier. It widens at Shadipur. On either side of the valley are forest of pine, and other fruit trees. The famous lakes of Vishnasar, Krishnasar and Gangabal are within the catchment of Sind River which attracts large number of tourist every year.

c) **Lolab Valley:**Lolab valley is oval shaped about 25 kms long and 5 km wide. It is traversed by Lahwal stream. The valley is covered by thick forest of deodar. The pastures are the grazing field. This valley is also known for cherry, apple, walnut and peach (Ahir, 2007 b)

5. **Greater Himalayas**: To the north of Pir Panjal and Dhauladhar ranges are the more lofty ranges of the innermost zone of Himalayas rising above the snow line. The greater Himalayas along with the Zaskar range lie in the north of Kashmir valley. The great Himalayas have ranges of more than 6000 mts in altitude. The region is heavily glaciated and has remnant glaciers and snowfields. Further north till the peak K2 (second highest peak in the world) in the Karakoram Range attains the height of 8621 mts. The Zaskar range is having the altitude of 5940 mts. Zaskar range has two river valleys Zaskar and Suru. The Kargil town lies in the Suru valley. The Karakoram Range is known as "roof of the world". The zone receives some rain from the southwest monsoon winds in the summer months and hence the lower slopes are forested. The mountains act as climate divide between the Indian subcontinent climate and continental central Asia climate.

6. **Laddakh Plateau**:It is the plateau region with the cold desert with no rainfall. It is devoid of any vegetation cover. Laddakh is the loftiest inhabited region. It stretches from south-east to north-west with the altitude ranging 5180-6400 mts. Aridity of atmosphere; the climate is extreme, from hot desert to several degrees below freezing point at night. Zonskar, Lahoul and Rupshu are some district having few saline lakes and marshes. Peaks like K2, 8615 mts (Karakoram), Nanga Parbat 8119 m (Kashmir Himalayas), Gasherbrum 8073m (Karakoram) are found here (Ahir, 2007 c)

Climate of Kashmir Region

Jammu regionin the southhave humid subtropical or monsoon climate. In the north hilly areas experience temperate type of climate. In winters temperature is 5 to 10^0 C. In summers dry and hot winds blow and known as Loo. **Kashmir Valley** experienced temperate type of climate with harsh and cold winter with temperature even less than -10 to -20^0 C. **Laddakh**have very less rainfall in the form of snowfall so it is very dry. The winter temperature even goes down to -40^0 C (Ojha, 2007b)

Major Rivers: The drainage system of Kashmir region is antecedent in nature Means Rivers are older than the mountains they traverse. Chenab is the major river of Jammu region; Jhelum is of Kashmir region and Indus is of Laddakh region. **Chenab**: The River is 1180 kms long formed by two streams Chandra and Bhaga in Himchal Pradesh. The river flows between Himlayas and Pir Panjal Range and then takes a south turn and flows through Doda, Reasi and Aknoor. At Aknoor the river is in plain stage and is navigable. **Jhelum**: It originates from Pir Panjal ranges and is known as Veth in Kashmir valley at Baramulla. It is known as Kashur Dariya and after joining the kishanganga, it is called Jhelum. Jhelum joins the Indus in the Punjab state of Pakistan. The Sandran, Breng, Arpat, Lidder, Sind, Pohru are the right bank tributaries, while Vishav, Romushi, Dudhganga, Ningal are the left bank tributaries. **Indus**: Common name of Indus is Singge-chhu which means the Lion –River or Sher- Darya. It rises from Mansarover Lake in Tibet and enters Jammu and Kashmir. It flows north-westerly direction between Kailash and the Laddakh range. Hanle, Suru and Zanskar are the left bank tributaries whereas Shyok, Shigar, Astor and Gilgit are the right bank tributaries. Finally, through Pakistan, it falls in the Arabian Sea near Karachi. (Ojha, 2007c)

Vegetation cover: Main types of Vegetation cover are: Sub-tropical dry deciduous forest, Sub- tropical pine forest, Himalayan moist temperate forest, Himalayan dry temperate forest andAlpine forest. Alpine pastures known as margs and evergreen conifers are found in high altitudes, Scrub forest and deciduous forest are found in **Shiwalik** foothills and Pir-Panjal range. Laddakh have Xerophytic vegetation. Himlayan temperate forest is found in mountainous areas. **Jammu** has Kikar, Ber, Pipal, Shisam etc**. Kashmir** has chir, deodar, spruce, maple, oak walnut poplar etc. **Laddakh** has firs, rhododendron, junipers etc. (Ohja, 2007 d)

Wild Life: Black-necked crane, peacock, ducks, pigeons are found in **Jammu & Kahmir**. Yak, Tibetan antelope, Tibetan wild ass, Red apnda, Snow leopard, bear etc are found in **Laddakh region** while Hangul is found in DachigamNational park at**Srinagar**.

Social Life: Population of Kashmir region according to census 2011 is 12548926. Kashmir region records 30.4 percent of population growth with 124 population density and 883 sex-ratio. 50 percent of population lives in rural area and 50percent population lives in urban area. There are 7.38 percent of Scheduled Caste population and 11.91 percent of Scheduled Tribe population. Kashmir division is largely Muslim (96.41%) with a small Hindu (2.45%) and Sikh (0.81%) population. Among Muslim, about 10% percent,are Shias, remaining beinmg Sunni. Majority of the population is made up of ethnic Kashmiris, with a significant minority of Gujjars and Bakarwal. The majority of the population speaks Kashmiri (85.50%), while the remainder speaks either Gujjari, Pahari or Hindi. Urdu is also widely understood as a literacy language in Kashmiri, due to it being medium of instruction in schools. Lietracy rate is 77.3 per cent. Of that, male literacy stands at 85.7 per cent while female literacy is at 68.0 per cent (Census, 2011a). Kashmir has a diverse blend of many cultures. Kashmir has made huge contributions towards the world culture in the form of crafts, written words, oral histories etc. Pehran is the tradition dress worn by people in winters. Kashmiri food is mainly meat-based, Kahava is traditional green tea. Dishes are Kashmiri Pulao, Karam Sag, Dum Aloo. Phirni, etc. Major dance form isRuff dance, Chakri, Dogri dance. Muslical instruments are Dukra, Sitar and Nagara.

Economy: Major source of income is tourism, Manufacturing of rural crafts, including weaving, wood carving, leatherwork, silverwork, copper work, jewelleryetc. large orchards in the Vale of Kashmir produce apples, pears, peaches, walnut, almond, cherries, are the major exports. Vale is the sole producer of saffron in the Indian subcontinent. Mineral reserves are also contribute to the economy of the state (Statistical Bulletine, 2011, Kashmir)

13.3.4 GEOGRAPHICAL STRUCTURE OF UTTARAKHAND

On the basis of geological structure, topographical configuration and surface texture Uttrakhandcan be divided into the following geographical area:

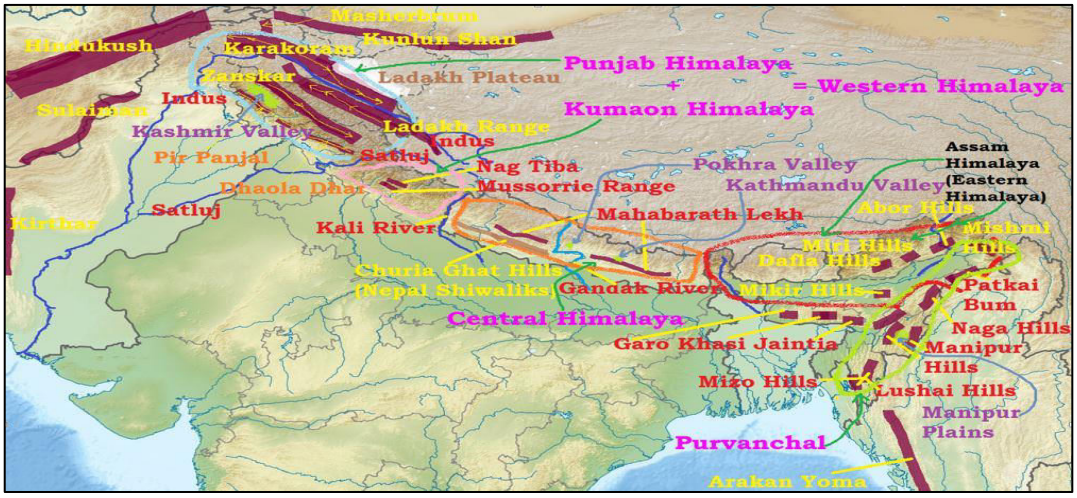
1. Trans Himalayas

2. Greater Himalayas
3. Lesser Himalayas
4. Shiwalik

Each geographical region is separated from one-another by the Himalayan Frontal Thrust (HFT), Main Boundary Thrust (MBT), Main Central Thrust (MCT) and Tethys Fault (TF). The extent of Uttarkahnd Himalayan region is 28^0 44' & 31^0 28' N Latitude and 77^0 35' & 81^0 01' E Longitude.

Trans-Himalayas: The trans-Himalayas extend to the last extent of the North-eastern part of Uttarakhand. To the south, it is separated from the greater Himalayas by the Tethys Fault. It is also called the rain shadow area. In fact it is only part of the greater Himalayas which was discovered by Sven-Heden in 1963. This part is made up of sedimentary rocks whose age is estimated from 70 million to 600 million years.

Fig: 13.5 Trans Himalaya



Source: Goggle Images

Greater Himalayas: The part is captivate due to high snow peak, snow valleys, snow, very cold and drop down valleys etc. due captivate scene. It extends from the main Central Fault (MCT) to the border of Tibet (China) in the north. The major snow peaks of this region are:

Table 13.1: Mountain peaks of India and their height

S. No.	Mountain Peaks	Height in Meters
1.	Bandar Puch	6315 m
2.	Kedarnath	6940 m
3.	Satopanth	7075 m
4.	Champawat	7138 m
5.	Kamet	7756 m
6.	Neelkanth	6569 m
7.	Trishul	7045 m
8.	Nanda Devi	7815 m
9.	Panchachuli	6905 m
10.	Yung Tangto	5945 m

Source: Google

Much important topography formed by glaciers is found in this part. The main relief of greater Himalayas is between 4800 mts. to 6000 mts. The highest mountain peak of Uttarakhand- Nanda Devi (7817 mts) is in this part. The greater Himalayas is also known as Himadari, Mahahimalayas and snowy Himalayas. In the Warmer part of this Himalayas ancient rocks like granite, gneiss, etc are found in the lateral regions. There are transverse and sedimentary rocks in which marine remains or deposits are found. Main inhabitant of this area is Bhotiya tribe whose main profession is trade and cattle taming. Temperature is at the lowest here, so, it is generally covered with snow, for this reason, it is less populated area with rare agricultural produce.

There is no vegetation above 12,000 feet here, whereas up to 10,000-12,000 feet grass and bushes grow. The valley of flowers is located herein Chamoli, in other words (temperate zonal) vegetation is found here. In this part of the Himalayas various mountain peaks, passages and glaciers exist (Thapa and Khan 2022a).

Areas Passes

(Uttarkashi – Tibet): Thangla, Mulinga-La, Byang- La

(Uttarkashi-Chamoli): Kalinidi

(Chamoli-Tibet): Neeti, Mana, Shal-Shal, Balcha, Chura, Lamlang

(Chamoli-Pithoragarh): Barahoti, Marchyok, Latudhura

(Pithoragarh- Tibet): Lipulekh, Milam, Dharma, Kingari, Vingari, Unta Jayanti

(Pithoragarh-Bageshwar): Trailpass

(Pithoragarh- Champawat): Lapsa-Dhura

(Bageshwar-Chamoli): Sunderdhunga

Glaciers

Pithoragarh- Milam, Ralam, Ponting, Namik, Pinora

Chamoli- Satopant, Dunagiri, Tibarabamar

Bageshwar- Pindari, Sunderdhunga, Kafani, Mektoli

Uttarkashi- Gangotri, Yamunotri, Doriyani

Tehri- Khatling

Rudraprayag- Chaura Barhi

The biggest glaciers of Uttarakhand is Gangotri/Gomukh Glaciers.

Lesser Himalayas

In between the shiwalik and greater Himalayas, there is a vast central part of Uttarakhand. It is from 1800 to 4500 meters height with the breadth of 70 to 100 kms. in the state. No fossils are found here in it because it too has been transformed. The rocks in this part are consisted of Granite, quartz, and lime stone etc. In this part of the Himalays, Dhauldhar,

Peer-Panjar, Shiva, Nag, Mahabhart, Mussoorie, Nainital, Landsdown and other hill lies these areas tourists because the average summer-season temperature is 18^0- 20^0 here.

Here in this temperature zone mainly, Oak, Rhododendron, Deodar and Stone Pine grow. On both the side-slopes of this part of the Himalayas; there are fields of soft grass (Alpine Pastures) which are called Bugyals in Garhwali dialects and Payar in Kumauni dialects. In comparison to great Himalayas more agricultural work is carried out in this part of the Himalayas. The production of paddy, wheat, maize, Mandua, Jhangora is more than that of greater Himalaya's production. Various kinds of vegetables are grown in the region of Kumaun here. Moreover Apple, Nuts, Peach like subtropical fruits are produced here. The commercial importance of population of this region is more in comparison to the population of the great Himalayas. Lakes-like Nainital, Bhimtal, Shukhatal are situated in this region of Himalays.

Many rivers flow with their tributaries form a pleasant topography due to erosion. The main rivers are Ganga, Yamuna, Tons etc. These rivers have deep and narrow at some places (Thapa and Khan, 2022b)

ShiwalikOuter Himalayas

It is the southern part of the Himalayas. It is 700-1800 meters in height and 10-20 kms. in breadth. Fossils are found in this part of the Himalayas because the rocks have not reached at transformation stage here. Minerals shells like lime stone, Balua, Sangmarmar (Marble), Gypsum etc. are found and Sal, Sagaun, Sheemsham, Pine like Vegetation grow here.

Small Himalayas is prone to earthquake whereas Shiwalik is prone to Landslide. There are square shaped valley between Shiwalik and small Himalayas which are fertile for agriculture. These are called Dun in the West and Dwar in the East i.e. Dehradun, Pachawadun, Harikund, Kotdwar etc. Dehradun is the most important among these. Because of the high fertility and favorable climatic condition, it is thickly populated. (Thapa and Khan, 2022c)

Plain Area

Plain area of Uttarakahnd is divided into three categories:

Bhabar Region

It is the part of the Himalayas where the rivers descending from the Himalayas bring and deposit big rocks, pebbles and sediments. It is rough and unproductive part from agricultural point of view and the rivers seem to vanished here. From the east of Udhamsingh Nagar to the west of Dehradun, it is spread in the form of 10-12 kms broad belt.

Plain (Tarai) Region

The part of plain area which is formed with minute sedimentary grains of soil is called Tarai. In the form of 20-30 Kms. A broad belt is spread in Haridwar, Pauri and Udhamsingh Nagar. Because of enough rain, soil is moist here and consequently, it is fertile from agricultural viewpoint. Because of the abundance of rain, marshy area is found here, for this reason National Sanctuary is established here. The area is being developed with the effort of G.B. Pant Agricultural University and Tarai Land Development Project.

Southern Plain of Ganga

The part of the Ganga which is formed with the sediments of the Ganga is called Ganga Ka Maidan. The plain region of Southern Haridwar lies in it (Thapa and Khan, 2022d).

Drainage or River System of Uttarakahnd

There are three major river systems in UttarakahndHimalayas:

1. The Ganga River System
2. The Yamuna River System
3. The Kali River System

1. The Ganga River System

In Uttarakahnd, the river Bhagirathi and Alaknanda join together to form the river Ganag and at the Haridwar, the other tributaries like Ratmau and Solani join the river Ganga as well. Its length from Devpryag to Haridwar is 90 Kms. There are two main sub-system of Ganga river system are: (a) Alaknanada River Syatem. (b) Bhagirathi River System

a) **Alaknanda River System**: The Alaknanda River originates from Satopanth Glacier in Chamoli of Uttarkashi district. Its length is 195 kms. Its tributaries are Saraswati, Dhauliganag, Nandakini, Laxmanganag, Pindre etc.

b) **Bhagirathi River System**:The Bhagirathi River originates from Gomukh glacier in Uttarkashi district. Its length is 205 kms. The main tributaries are Dudhganga, Ramganaga, Balganag, Kedarganag, Jodhganag, Asiganag etc.

2). **Yamuna River System**: Yamuna river originates from Yamunotri glacier situated on the western slope of Banderpuch mountain in Uttarkashi. The most prominent tributary of Yamuna River is tons river which bring two and half time more water than the Yamuna. The other tributaries are: Rishiganaga, Hanumanganag, Krishna Gad, Kamal Gad etc.

3). **Kali River System**: Kali river is located far north of Pithoragarh, near the Tibetan border. Locally it is known as Kaligad or Kaliganga. It flows along the Indo-Nepal border. There are 3 main sub system of Kali river: a) Gauri Ganag b) Sarayu Ganga c) Lodha Ganga. After Pithoragarh, the river flows through Champawat and enter Nepal under the name Sharda from Brahmdev near Purnagiri in Tanakpur (Ojha, 2007e)

Lakes of Uttarakhand Himalayas

Uttarakhand is home of some of the most beautiful lakes of India, which attracts the large number of tourist. Major lakes of Uttarakhand are: Sat Tal, Naini Lake or Nainital Lake, Kedar Tal, Roopkund, Sato-Panth Tal, Bhi Tal. **Sat Tal** is one of the major tourist attraction situated in the Nainital District of Uttarakahnd. It is situated in the lower range of Himalayas. It is an inter-connected group of seven freshwater lakes hence it is called Sat Tal. **Naini Lake or Nainital** is the fresh water lake shaped like kidney. Various species of flora and fauna are found around the lake. It is 28 mts deep at the deepest and 6 mts at its shallowest. **Kedar Tal**it originates in high Himalayas and joins Bhagirathi. It is a mountain lake formed from glaciers. **Roop Kund**it is highest altitude lake and 2 mts in depth, originate from glacier. It is visible only when the ice melts. **Satopanth Tal** it is triangular lake. Lotus flower is found abundance in this lake. The lake has religious significance; it is belived that 3 deities Vishnu, Shiva and Brahma occupy one corner of each of this lake. **Bhim Tal** it is one of the largest and most impressivelake of the state. It is C shaped lake and has huge catchment area (Ojha, 2007f)

Soils of Uttarakhand

Many types of soils are found in Uttarkahnd because of different terrestrial, climatic and botanical characteristic these are:

1. Tarai-Bhabar Soil
2. Brown Red Yellow Soil
3. Sub-Mountain Soil
4. Mountain Grassland Soil
5. Mountain Shallow or snowy soil
6. Ancient Comapct Soil

Tarai Bhabar Soil: the foot region of Uttarkahnd is known as Tarai- Bhabar region. The slope of this soil is very low. The extent of soil is more in Udhamsingh Nagar of Kumaon region. **Brown Red and Yellow Soil** The extent of this soil is from Kumaon to Garhwal in the shiwalikHimlayas. Due to the remains of underlying vegetation, its colour is different in different area. **Sub- Mountain Soil** it is found in central part of Uttarakhand from Kali River in east to the western border of Garhwal. The amount of Humas is high due to which its fertility is high. Mountain Grassland Soil it is spread in high mountaneous region of Kumaon and Garhwal Himalays in Uttarkashi, Chamoli, Pithoragarh. **Mountain Shallow or Snowy Soil** it is spread over Pithoragarh, Uttarkashi and Chamloi district. Due to lack of vegetation cover and low temperature it is not suitable for agriculture. Ancient Compact Soil it is found in Doon Valley of Uttarkahnd. It is formed at places where river deposit its sediments (Thapa and Khan, 2022e)

Climate of Uttarakhand: Uttarakhand Himalayas are the integral part of Himalayas due to which its climatic conditions are similar to the climatic conditions of Himalayan region. S.D. Toshik has divided the climate of Uttarakhand into 6 types:

1. Sub Tropical Climate
2. Warm temperate Climate
3. Cool temperate Climate
4. Cold Climate
5. Alpine Climate
6. Glacial Climate

Sub Tropical Climate: In Uttarakhand,tarai and Babhar in the lower valley**s** has the extension of sub-tropical climate. Winter is harsh and summer temperature is 18^0C to 21^0C. There is cyclonic rainfall which occurs mainly in winter. The climatic condition is ideal for agriculture, agriculture work and vegetation covers. **Warm temperate Climate**: Areas of Shiwalik mountain range from 900 to 1800 mts are areas with warm temperate climate. Temperature in winter is 6 to 10^0C and summer is 21^0 to 27^0 C. Rainfall is caused due to monsoon rainfall. **Cool temperate Climate**: It is found in the areas of 1800 to 2400 mts altitude areas. Annual average temperature is 10^0 to 13^0 C. Weather in the month of October and November is pleasant. **Cold Climate**: In Himalayas,Garhwhal region with altitude of 2400 to 3000 mts registered this type of climate. The average annual temperature ranges between 4^0 to 10^0 C. Winters are very hash and long, the monsoon winds bring rain in rain**. Alpine Climate**: Uttarakhand experience Alpine climate in areas with an altitude of 3000 to 4200 mts. The average annual temperature ranges between 3^0 to 5^0 C mts. Under this northern region of Garhwal and Kumaon Himalayas comes. Winters are very hash and long. The ecological productivity of this region is lower than other climatic zone. **Glacial Climate**: In Uttarkahndther is an extension of glacial climate in the areas with altitude of more than 4200 mts. The average annual temperature remains below the freezing point i.e. 0^0 C. Temperature in January is -12^0 C. In June temperature rises a bit. Animals and birds living in this region has adapted this environment and ecological productivity is very low (Thapa and Khan, 2022f).

Social Life: Upon the life style of people of any region, there is the direct impact of the geographical conditions. The inhabitants of hilly region live in typical geographical conditions. The life of hilly people is full of more struggles comparatively. Even then, the women have more struggle capacity for labour and struggle in comparison to men. Men of Uttrakahnd are working in different fields of profession in plain areas. According to the final data of census of 2011, the total population of Uttarakahandis 1,00,86,292. Among which 51,37,773 (50.90%) are men and 49,48,519 (49.07%) are women. According to census of 2011, during 2001-2011, the rate of population growth in a decade was 18.81% which is more (by17.7%) than that of this decade's national average. Census 2011 shows that population density of Uttarakahand reaches to 189 and sex ratio is 963 more than national average i.e. 943. The average literacy rate of Uttarkhand is 78.82% which is more than the average literacy of India (73.00%). Male literacy rate is 87.40% and female literacy is 70.00% and this is more than the average national literacy of 80.90% and

64.60% respectively. Census 2011 shows that 69.77% population lives in rural areas and rest 30.23% population lives in urban areas. The percentage of SC population, out of the total population of the state,is 18.8% and ST Population is 2.9%.

Major section of the population in Uttarkhand is Hindus. According to census 2011, there were 82.97% Hindus of the total population, whereas people following Islam were 13.95% and those following Sikhisim were 2.34%, Chritianity 0.37%, Buddhisim 0.15% and Janisim 0.09%. The land of Uttrakhand is full of artisians and variety of art and craft. Woodwork is a significant art form that the locals of Uttrakhand practice. Popular languages of Uttarkahnd are Hindi, Kumaoni, Garhwali, Jaunsari and Bhotiya. Chhopati and Jhumeila are the major folk dance. Harela, Diwali, Ganga Dasseraetc are the main festivals (Thapa and Khan, 2022g).

Economy: Uttrakhand is largely depending on tourism as the main source of economy. The numerous hill stations that attract tourists from all over the world, results in development in tourism. Apart from hill stations, wildlife sanctuaries like Corbett National Park and the famous Tiger reserve have also become popular tourist destination. Second largest contributor of economy in Uttrakhand is Agriculture sector. The major crops are cereals, pulses, oilseeds, sugarcane and onion. Revenue is also collected by the orchard farming like apples, oranges, pears, litchis, plums, peaches etc. (Thapa and Khan, 2022h)

13.3.5 PROBLEM AND PROSPECTS

1. Climate change is the main factor behind the accelerated glaciers retreat observed in the Himalayas.Uttarakhand Himalayas have the largest concentration of glaciers outside the polar region and hold vast stores of fresh water. Continued climate change is predicted to lead to major change in fresh water flows with climatic impacts on biodiversity, people and their Livelihood.
2. Conversion of forest to agricultural land for building, timber, fuel wood, overgrazing of animals in forest causes significant damage to natural ecosystem and biodiversity.
3. Poaching is major threat to the endangered species like tiger, elephant, rhinos etc.
4. Infrastructure development also causes great harm to the Kashmir and Uttrakahnd Himalayas.

5. Climate change adaptation and biodiversity conservation will be mainstreamed into the management of river system.
6. A mosaic of over 7 million hectare of high conservation value forest, grassland and wet land will be secured, connecting 1500 kms of conservation areas
7. Valuable population of iconic and threatened species will be secured and will live in harmony with human communities.

13.3.6 SIGNIFICANCE OF KASHMIR AND UTTARAKHAND HIMALAYAS

The mighty Himalayas are the most pronounced and dominating physiographic features of the subcontinent of India. It has often been said that Himalayas are the body and soul of India. The importance of the Himalayas has been given briefly in the following lines.

1. Ihe impact of the Himalayas on the climate, especially on the distribution of precipitation and temperature, is quite significance.
2. Throughout history the foreign invaders never entered India from the northern side.
3. Most of the perennial rivers of northern India have their origin from the glaciers, lakes and springs of the Himalayas. These rivers sustain the teeming of millions of the India'spopulation.
4. The Bhakra-Nanagal Dam, Tehri Dam, Koteshwar, etc are some of the important hydel-power generating multi-purpose projects located in the Himalayas.
5. The Himalayas ranges are very rich in forest resources.
6. The Himalayas are known for the apple, peach, cherry, pear, mulberry, walnut, almond and apricot, orchard.
7. The Himalayas are rich in many metallic and non-metallic minerals like coal, limestone, gold, silver etc.
8. The Himalayas are known for their scenic and aesthetic beauty all over the world. Millions of national and International tourist visits the hill stations in the Himalayas.

9. Himalayas are the centers of numerous pilgrimage like Amaranth, Kailash, Vaishno devi, Kedarnath, Badrinath, Gangotri, Yamunotri, Hemkund etc.

13.4 SUMMARY

The Kashmir is part of the Greater Himalayas in Kashmir. It is divided in six physiographic regions: The Outer Plain, The Shiwaliks, The Lower Middle Himalayas, The Valley of Kashmir, The Greater Himalayas and The Plateau of Laddakh. The north-eastern region is cold desert, spread between Greater Himalayas and Karakoram ranges. Karakoram, Zasker, Laddakh, Pir Panjal are some major ranges of this region. Important Saltwater lake is Pangong Tso and Tso Morii and the freshwater lake is Dal Lake and Wular Lak. Chenab is the major river of Jammu region, Jhelum is of Kashmir region and Indus is of Laddakh region. In the north-western Himlayas important glaciers are Baltoro and Siachine. Major passes are Banihal La (Pir Panjal), Zoxi La (Great Himlayad), Photu La (Zaskar) and Khardung La (Laddakh range). Zafran, local variety of saffron cultivated in Kashmir Himalayas in Karewas. Pilgrimage spots like Amarnath cave, Chahar-e-Sharif, Vaishno Devi. Dunes like Jammu Dun, Pathankot Dun is found in this Kashmir region. Uttarakhand Himalays are found in between the Ravi River in the west and Kali River in the east. The region is drained by two major river systems; Indus and its tributaries (Ravi, Beas and Sutluj) and the Ganga and it'sTeributaries (The Yamuna and Ghagra). In this region famous prayags are situated Dev Prayag, Rudra Prayag, Karan Prayag, Nanda Prayag and Vishnuprayag. All the three ranges of Himalayas are there, The Great Himalayas, Lesser Himalayas, and the Shiwalik Range. Mussorie, Almora, Ranikhet, Kasauli, Landsdownetc are tourist spots. Important dun are Dehradun, Karike Dun, Kota Dune. The Bhotias are the nomadic people live in the valleys in Great Himlayas move between Bugyals (Summar Grasslands of Higher Hills) during winters return to the valley. Famous valley of flowers situated in this region.

13.5 GLOSSARY

Dun: The Longitudinal Valleys.

Longitudinal Division of Himalayas: Longitudinal division of Himalayas is in the east-west direction across the northern India.

HFT: Himalayan Frontal Thrust. Geological fault in the Himalayas that defines the boundary between the Himalayan foothills and the Indo-Gangetic plains.

Karewas: the thick glacial clay deposits and other materials embedded with morains.

MBT: Main Boundary Thrust. Geological fault in the Himalayas that defines the boundary between the Himalayan foothills and the Indo-Gangetic plains

MCT: Main Central Thrust. Major geological thrust where the Indian plate has pushed under the Eurasian plate along the Himalayas.

Prayag: are sacred places of Hindus

TF: Tethys Fault

13.6 ANSWER TO CHECK YOUR PROGRESS

1. Do you know that the Yamuna River originates from the Yamunotri Glacier, situated on the western slope of Banderpuch Mountain in the Uttarkashi district of Uttarakhand?
2. Do you know that in Uttarakhand, the rivers Bhagirathi and Alaknanda join together to form the river Ganga?
3. The Main Boundary Thrust (MBT) zone separates the outer Himalayas from the lesser Himalayas.
4. Do you know that Duns refer to the longitudinal valleys which are created when the Indian plate and Eurasian plate collide and result in folding and the well-known duns in India include Dehra Dun, Kotli Dun and Patli Dun?
5. Do you that the largest dun in India is Dehra Dun?

13.7 REERENCES

1) Ahir, R. (2007a). Geography, Spectrum Books Publication Pvt. Ltd. (New Delhi), Pp. 442-444.

2) Ahir, R. (2007 b). Geography, Spectrum Books Publication Pvt. Ltd. (New delhi), Pp. 446-447.

3) Ahir, R. (2007 c). Geography, Spectrum Books Publication Pvt. Ltd. (New delhi), Pp. 449-451.

4) Google Images (a): Physiographic Division of India, Retrieved on 11, May, 2023, https://www.google.com/url?sa=i&url=https%3A%2F%2Fpocketgyan.com%2Fphysical-division-of-india-himalaya-range%2F&psig=AOvVaw0TkjueUTrWy_eE7f66fVZ9&ust=1685023216563000&source=images&cd=vfe&ved=0CBEQjRxqFwoTCKit-YaPjv8CFQAAAAAdAAAAABAE

5) Google Images (b): Physiographic Division of Himalayas, Retrieved on 11, May, 2023 https://abhipedia.abhimanu.com/Uploads/image/image 1%283%29.png

6) Google Images (c): Longitudinal Division of Himalayas, Retrieved on 11, May, 2023 https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.gktoday.in%2Fregional-divisions-of-himalayas%2F&psig=AOvVaw1svVM-y4LnWEopwlZrvKtr&ust=1685026960013000&source=images&cd=vfe&ved=0CBEQjRxqFwoTCPD66eScjv8CFQAAAAAdAAAAABAJ

7) Google Imapes (d): Physiography of Kashmir region, Retrieved on 11, May, 2023 https://www.google.com/url?sa=i&url=https%3A%2F%2Fbaljitdhaka.com%2FPhysiographic-Divisions-of-India-Part-1-Geography-Frontier-IAS&psig=AOvVaw0e09IEtCMeNOmWOXygVQro&ust=1685189947770000&source=images&cd=vfe&ved=0CBEQjRxqFwoTCJjz4Pz7kv8CFQAAAAAdAAAAABA6

8) Google Images (e): Longitudinal Division of Uttarakhand, Retrieved on 11, May, 2023 https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.pmfias.com%2Fhimalayas-regional-divisions-punjab-himalayas-assam-himalayas-western-himalayas-central-himalayas-eastern-himalayas%2F&psig=AOvVaw06Lxp-Cuy2rLou8MH__o9Q&ust=1685087106915000&source=images&cd=vfe&ved=0CBEQjRxqFwoTCMDdvvL8j_8CFQAAAAAdAAAAABAN

9) Hussai, M. (2008). Geography of India, McGraw Hill Education (India) Private Limited, pp. 2.8 to 2.11.

10) Khullar, D.R. (2003). *ISC Geography*, New Delhi, Kalyani Publishers, pp. 21-22.

11) Ojha, S.K. (2007a). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, p. 32.

12) Ojha, S.K. (2007b). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, p. 33.

13) Ojha, S.K. (2007c). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, p. 34.

14) Ojha, S.K. (2007d). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, p. 35.

15) Ojha, S.K. (2007e). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, p. 36

16) Ojha, S.K. (2007f). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, pp. 36-37

17) Statistical Bulletine, 2011, Kashmir. Retieved on 11, May 2023.

13.8 TERMINAL QUESTIONS

A- LONG TYPE QUESTIONS

Q.1 With a suitable diagram explainsthe physiographic division of Uttarakhand Himalayas.

Q.2 Briefly describe the physiographic division of Kashmir region

Q.3 Examine the Drainage system of Utatrakhand Himalayas.

Q.4 Discuss the socio economic life of Kashmir region.

Q.5 Discuss the socio-economic life of Uttarakhand Himalayas.

B- SHORT TYPE QUESTIONS

1. What is the significance of the Kashmir region?

2. Which major rivers flow through the Kashmir region?

3. What is the primary economic activity in Uttarakhand Himalaya?

4. Which famous pilgrimage sites are located in Uttarakhand Himalaya?

5. What is the ecological significance of the Uttarakhand Himalaya region?

C- MULTIPLE CHOICE QUESTIONS

1. What is the primary river that flows through the Kashmir region?

A. Ganges

B. Jhelum

C. Yamuna

D. Brahmaputra

Answer: B- Jhelum

2. Which major conflict centers on territorial disputes in the Kashmir region?

A. World War II

B. Korean War

C. Indo-Pakistani conflict

D. Falklands War

Answer: C- Indo-Pakistani conflict

3. Which famous pilgrimage site is located in the Uttarakhand Himalayaregion?

A. Golden Temple

B. Mecca

C. Char Dham

D. Vatican City

Answer: C- Char Dham

4. What is the capital city of the Indian union territory of Jammu and Kashmir?

A. Srinagar

B. Jammu

C. Leh

D. Shimla

Answer: A- Srinagar

5. Which mountain range is the Uttarakhand Himalaya part of?

A. Rocky Mountains

B. Andes Mountains

C. Himalayan Mountains

D. Alps

Answer: C- Himalayan Mountains

6. What is the primary economic activity in the Kashmir region?

A. Tourism

B. Fishing

C. Manufacturing

D. Mining

Answer: A- Tourism

7. Which country has had a long-standing territorial dispute with India overthe Kashmir region?

A. China

B. Pakistan

C. Nepal

D. Bangladesh

Answer: B- Pakistan

8. Which of the following is a famous winter sports destination in the Kashmirregion?

A. Goa

B. Shimla

C. Manali

D. Gulmarg

Answer: D- Gulmarg

9. What is the predominant religion in the Kashmir region?

A. Hinduism

B. Buddhism

C. Islam

D. Sikhism

Answer: C- Islam

10. Which fruit is famous for its production in the Kashmir region?

A. Mangoes

B. Oranges

C. Apples

D. Bananas

Answer: c) Apples

Q.11 What is the "Roof of the World"

a) Karakoram Range b) Laddakh Range

c) Zaskar Range d) Pir Panjal Range

Ans.12 **a)**The Karakoram Range

Q.2 Sind Valley belongs to

a) Laddakh Plateau b) Kashmir Valley

c) Outer Plain d) Greater Himalayas

Ans. 2 **b)** Kashmir Valleys

Q.13 Karewas is the unique feature of-

a) Outer Plain b) Laddakh Region

c) Lesser Himalayas d) Kashmir Valley

Ans. 3 **d)** Kashmir Valley.

Q.14 Indus is the major river of

a) Kashmir Valley b) Outer Plain

c) Laddakh Region d) Shiwaliks

Ans. 4 c) Laddakh Region

Q. 15. 1) The ShiwalikRange, and the Lesser Himlayan range are the great Himalayas ranges from north-south

2) Dun formation is a unique feature of this area.

Which of the statement (s) given above is/are correct.

a) 1 only b) 2 only

c) Both 1 & 2 d) Neither 1 or 2

Ans.5 b) 2 only

- The Lesser Himlayan Range and the Shiwalik Range are the great Himalayas ranges from north-south.
- The 'Shiwalik' and 'Dun formation' are the physiographic features that identify this area.

Q. 16 Uttarakhand Himalayas stretch in rough between …..... in the west and …… in the east.

a) Ravi and Kali b) Kali and Ravi

c) Indus and Sutlej d) Sutlej and Indus

Ans. 6 a) Ravi and Kali

The Uttarakhand Himalayas stretch in roughly between Ravi (a tributary of Ghagra) in the west and the Kali (a tributary of Ghagra) in the east.

Q.17 What is the total population of Uttrakahnd according to census 2011.

a) 60 Lakh b) 25 Lakh

c) 1 Crore d) 85 Lakh

Ans.7 c) 1 Crore

According to the 2011 census total population of Uttrakhand is 1 crore (10086292).

Q.18 The biggest glacier of Uttrakhand is -

a) Milan b) Kafani

c) Gangotri d) Suderdhunga

Ans. 8 c) Gangotri

Q.19 Valley of Flower is situated in

a) Himachal Pradesh b) Jammu & Kashmir

c) Sikkim d) Uttarakhand

Ans.9 d) Uttarakhand

In Chamoli district of Uttrakhand on the way of Rishikesh- Badrinath, the valley of flowers is situated. It has been included in the world heritage.

UNIT 14 - DETAILED STUDY LOWER GANGA PLAIN

14.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Know the extent and origin of Lower Ganga Plain.
- Understand the detail of the physiographic division of Lower Ganga Plain.
- Understand in brief the socio-economic conditions of Lower Ganga Plain
- Discuss the problem and prospects of the region.

14.2 INTRODUCTION

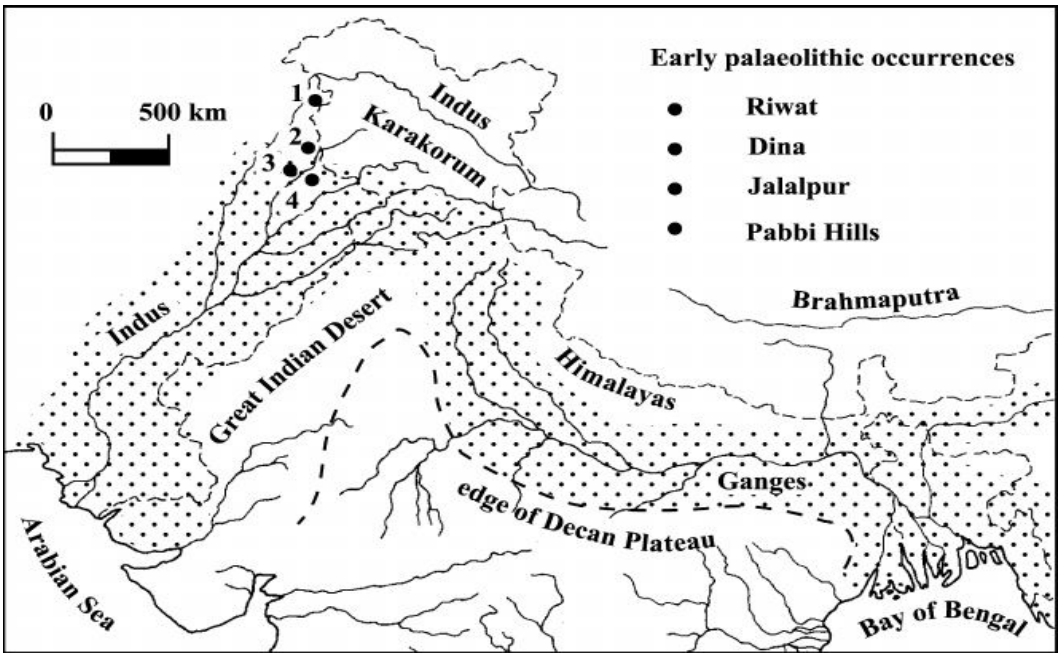
Present unit deals with the detailed study of the surface features, landforms, origin, extent and socio-economic situation of the Lower Ganga Plain. It deals with physiographic and morphological studyof Lower Ganga Plains. Description comprises of both physiographic division as well as socio-economic conditions. Unit starts with the formulation of few objectives as mentioned above. According to these objectives the study is conducted. Firstly the Indian Plains are divided into five physiographic divisions: 1)The Bharbar Plains, 2) The Trai Plains, 3) The Banghar Plains, 4) The Khadar Plains and 5) The Delta Plains and then the regional division of Great Indian Plain; is divided into fourdivisions: 1) The Plains of Rajasthan, 2) The Plain of Punjab-Haryana, 3) The Ganga Plain, 4) The Brahamapatura Plainwith suitable diagram. Further the Great Ganga Plainis divided into three divisions: 1) Upper Ganga Plain, 2) Middle Ganga Plain. 3) The Lower Ganga Plain. Then the detailed study of Lower Ganga Plain is done with suitable diagram. Further the brief description of climate, rivers, vegetation, wildlife and socio-economic life of Lower Ganga Plain is also worked out.In the last, Problem and Prospects and significance of the Lower Ganga Plainare worked out. A short Summary of Lower Ganga Plainis cited at the end. After the short Summary, Glossary and References are also cited and finally unit ends with some terminal questions.

14.3DETAILED STUDY LOWER GANGA PLAIN

The Great Plains of India lies to the south of the Shiwalik separated by the Himalayan Front Fault (HFF). It is a transitional zone between the Himalayas in the north and Peninsular

India in the south. It isa gradational plain formed by the alluvial deposits of the Indus, Ganga, Brahmaputra and their tributaries. The plain stretches for about 2400 kms from west to east. It has varying width, 90-100 kms in Assam, 160 kms near Rajmahal (Jharkhand), 200 kms in Bihar, 280 kms near Allahabad and 500 kms in Punjab. In general, the width of the plain increases from east to west.

Fig: 14.1Great Ganga Plain of India



Source: Google Images

The great Plains of India consist largely of alluvial deposits brought down by the rivers originating in the Himalayan and the peninsular region (Husain, 2008a)

14.3.1 Origin of Great Plains of India

The plains are believed to have resulted from infilling of an initial marine depression by detrital material. The initial depression is by detrital material. The initial depression was a 'fore-deep' formed in the wake of the Himalayas uplift. A part of it was formed, perhaps, due to subsidence of the northern flank of the plateau in its marginal process of mountain building. Two disconnected, outlying segments of the plateau- the Rajmahal hills, and Garo Hills-are in fact, two extremities of a depression created as a result of down warping of the peninsular block. This

down warping occurred due to faulting in an east-west direction. The Damodar River rift valley is an extension of the same process of down wrapping. This gap has since been filled by the Ganga-Brahmaputra alluvium.

Thus, the superficial alluvial deposits of the entire northern plains are resting on the continental shelf of a sea which has been receding since tertiary times leaving behind layers of marine and estuarine sediments, which has buried under the thick mantle of alluvium, which has spilled over the boundaries of the original trough. The major river systems of draining the northern plains are Satluj-Beas, Ganga-Yamuna and Brahmaputra. The unique features of this Ganga plain are unique level relief, levees and bluffs, older, alluvium terraces and ravines (Ahir, 2007a)

14.3.2 PHYSIOGRAPHIC DIVISIONS OF THE GREAT PLAIN OF INDIA

The Great Plains of India is a remarkable homogenous surface with an imperceptible slope. The northern plains of India may be divided into the following sub-regions.

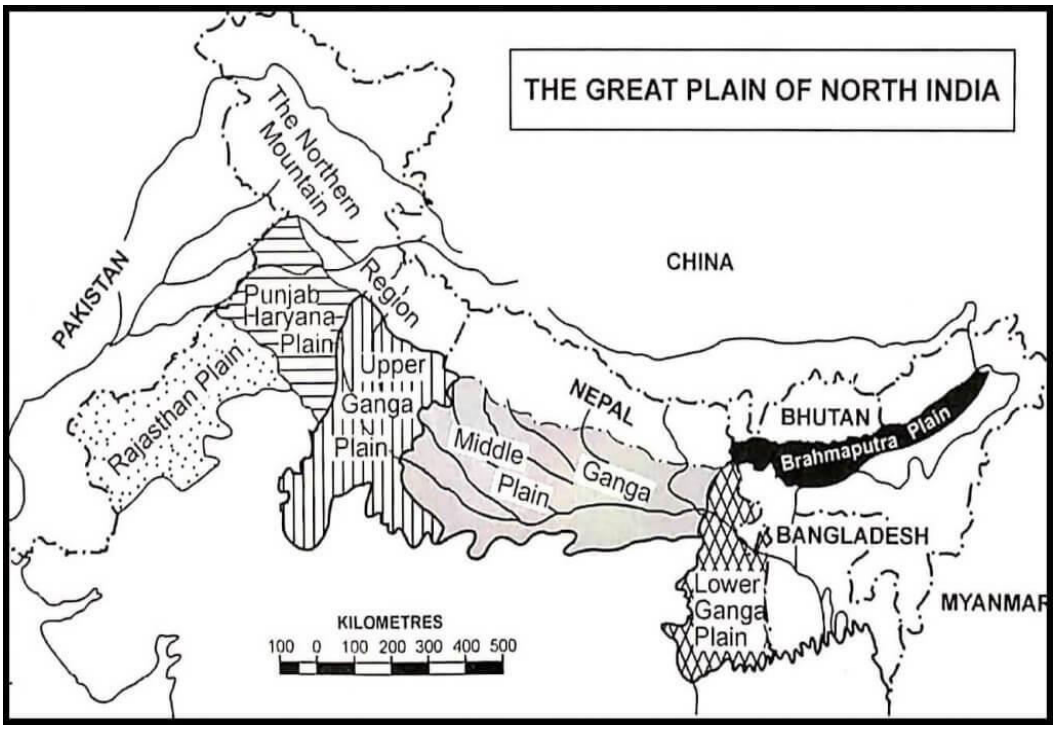
1. The Bhabar Plains
2. The Tarai Plains
3. The Bhangar Plains
4. The Khadar Plains
5. Delta Plains

14.3.3 MESO-REGIONS OF THE NORTHERN PLAINS OF INDIA

On the basis of geo-climatic and topographical characteristics, the Northern Plains of India may be divided into the following four meso-regions:

1. The Plains of Rajasthan
2. The Plains of Punjab-Haryana
3. The Ganga-Plains
4. The Brahmaputra Plains

Fig: 14.2 The Great plain of North India



Source: Google Map

14.3.4 THE GREAT PLAIN OF INDIA

The Ganga Plain lies between the Yamuna catchment in the west to the Bangladesh border in the east. It is about 1400 kms from west to east and has an average width of 300 kms from north to south. The general gradient of the plain is about 15 cms per km from north-west to south-east. The maximum height of this plain is found to the north of Saharanpur (276 mts) followed by Roorkee (274 mts), Agra (169mts), Kanpur (125 mts), Allahabad (98 mts), Patna (53 mts), Kolkata (6 mts), and Sagar Island only 3 mts above the sea level.

The main topograpicvariation in the plains include Bhabar, Tarai, Bhangar, Khadar, river bluffs (levees), abandoned courses, Khols, dead-channels, Bills, Tals, and Badlands. The Ganga Plains can be subdivided into following sub-regions:

a) The Upper Ganga Plain
b) The Middle Ganga Plain
c) The Lower Ganga Plain

a) **The Upper Ganga Plain**: The Upper Ganga Plain includes the Ganga-Yamnua Doab, Rohilkhand Division, and parts of the Agra Division. A unique feature of the Upper Ganga Plain is the presence of Bhur (undulating, Aeolian sandy deposits). Devoted for sugarcane, rice, wheat, maize, pulses, mustard, fodder, vegetables and orchard, it is one of the most productive plains of India in which the Green revolution is a big success.

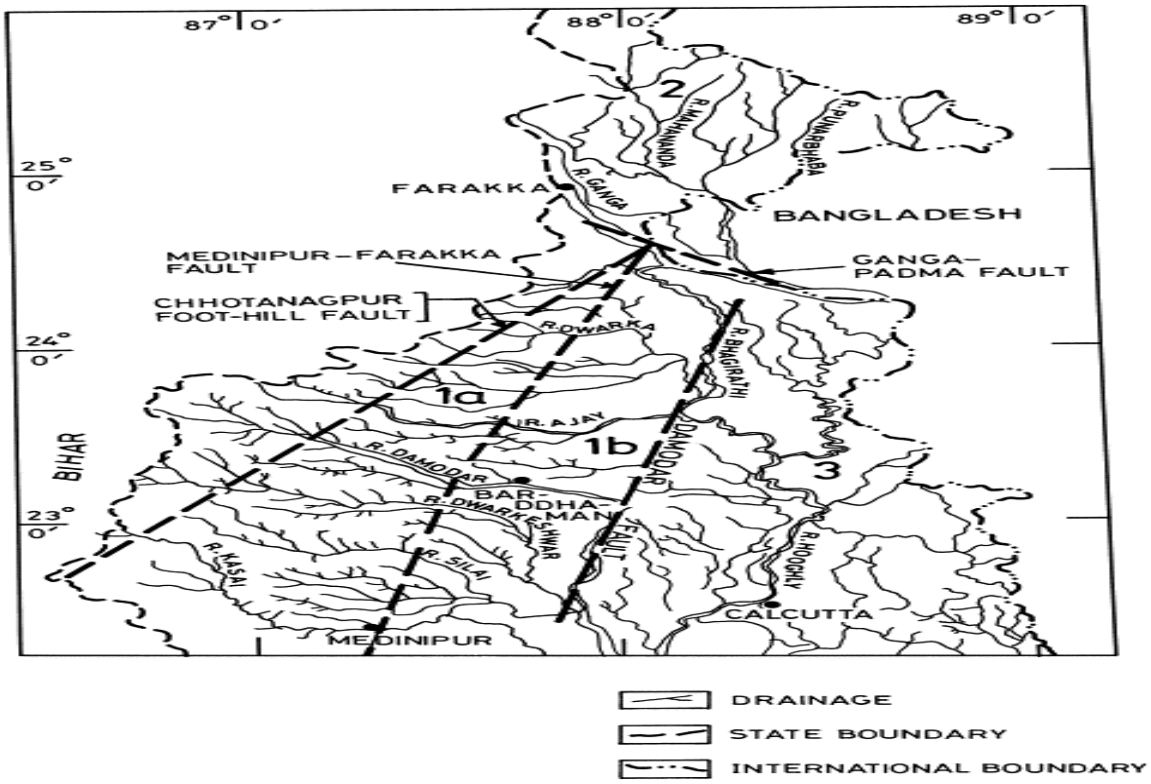
b) The Middle Ganga Plain: Sprawl over an area of about 144,400 sq kms, the Middle Ganga Plain includes central and eastern Uttar Pradesh, and the Bihar Plains up to Muzaffarpur and Patna. In the north, it is bounded by the Shiwalik along the Indo-Nepal border.

c) The Lower Ganga Plain: The Lower Ganga Plain extends from Patna in the West to Sunderban Delta in the east. It has monotonous surface. The lower Ganag Plain (LGP) of the Indo-Gangetic Plains is the extension of the Middle Gangetic Plains (MGP) to the southeast, and is particularly characterized by its greater humidity. Its extension is 24^0 2' N 89^0 35' E, comprises of countries Bangladesh, India, Mayanmar and states of Assam, Bihar, Odisha, Tripura, Uttar Pradesh, West Bengal. In India Lower Ganga Plain extends from Patna in the West, the foot of Darjeeling Himalayas in the north to the Bay of Bengal in the south. It is boarded by Assam and Bangladesh in the east and Chotanagpur Plateau in the west. In the lower part of Lower Ganga Plain is Sunderbandelta. The Plain has a monotonous face (Hussain, 2008b)

14.3.5 LOCATION AND EXTENT

The LPG is a triangle shape "arcuate" riverine delta located just above the Bay of Bengal, with a major portion coming in Bangladesh. The delta is over 350 km wide along the Bay of Bengal.

Fig14.3 Location and Extent



Source: Google Maps

Fig: 14.4: The great Indian plain.

Source: Google Images

The silt is brought by the rivers and deposited by the normal flow and flood; it is the largest delta in the world and is known as Green delta or Ganges- Brahmaputra River Delta. The LGP arises by the confluence of the Ganges from the west and flowing down to meet the ocean, The Brahmaputra, from northeast to the south and merges with Ganges, and Meghna towards the south meets with Padma and ends in to the Bay of Bengal. Thus the easternpart of the plain is drained by the Tista, Jaldhakia, Sankosh joining the Brahmaputra, and the western part is drained by the Mahananda, Ajay and Damodar. In extreme south-west by the Kasai and Subarnarekha. Administratively, in the east bounded by the north eastern hill states of Zindia, in the west by Jharkhand and Orissa, in the north by the part of undivided Bengal, andin the south by the Bay of Bengal.

Physically LGP is made up of three major regions:1) Brahamputra Alluvium, 2) Ganges Alluvium, 3) Tista Silt. **1) Brahamputra Alluvium**: comprises of the Dhaka, Tangail and Comilla of Bangladesh. 2) **Ganges Alluvium:** comprises of Kushtia, Jessore, Khulna, Rajshahi, Pabna and Dhaka of Bangladesh. 3) **Teesta Silt**: includes parts of Rangpur district, East Bogra and Sirajganj of Bangladesh and parts of West Bengal.

The LGP in India consists of four plain:1) Barind Plains West Bengal, 2) Central Alluvial Plains, 3) Alluvial Coastal Saline Plain and, 4) Rorh Plain. 1) **Barind Plains West Bengal:** Comprises of Dinajpur, Maldah.**2) Central Alluvial Plain:** Nadia, Bardhman, Hoogly, Howrah, Murshidabad, Medinipur. **3) Alluvial Coastal Saline Plain:** North and South 24 Paraganas,and**4) Rorh Plains:** Bankura and Birbhum.

14.3.6 LANDSCAPE

The Landscape is comprised of three major landforms, 1) Uplands, 2) Old Fluvial/Deltaic Plains and 3) Young Fluvial Plains.**Uplands:** The uplands consist of deciduous forests extends throughout the alluvial plains. **Old Fluvial/Deltaic Plains:** This Middle landform consists of fertile old alluvial plains largely replaced by with intensive agriculture and densely populated. **Young Fluvial Plains:** The lower deltaic region comprised of labyrinth channels, swamps, lakes and flood plains sediments.

14.3.7 AGROCLIMATE

The region is divided into; Tropical humid, Tropical Moist Humid, Tropical Sub-Humid. The overall climate is characterized by hot summers and mild winters. The LGP receives high rainfall both during summer and winter. Rainfall ranges from 1400 to 2000 mm. The dry period is only for a month. Thus the growing season is of 150 to 270 days. LGP eastern part is the major ecoregion of the world. West Bengal is further divided into six agro climaticsub regions:1) The northern hilly region, 2) The Tarai- Teesta Floodplain, 3) The Gangetic Floodplains, 4) The coastal Floodplains, 5) The Vindhya Old Floodplains, and 6) Lateritic Sub region of the Eastern Plateau. The Gangetic delta has fertile alluvial plains with mostly clayey in texture.

14.3.8 THE DRAINAGE SYSTEM OF LOWER GANGA PLAIN

The LGP arises by the confluence of the Ganges from the west and flowing down to meet the ocean, the Brahmaputra, from northeast to the south and merges with Ganges, and Meghna towards the south meets with Padma and ends in to the Bay of Bengal. Thus the eastern part of the plain is drained by the Tista, Jaldhakia, Sankosh joining the Brahmaputra and the western part is drained by the Mahananda, Ajay and Damodar. In extreme south-west by the kasai and Subarnarekha

14.3.9 SOILS OF LOWER GANAG PLAINS

Throughout the Ganga Plain in Uttar Pradesh, Bihar and West Bengal, alluvial soil is found. The Lower Ganga Plain has laterite, red and alluvial soils. Laterite soil exists in the southwestern part. They are acidic and lack humus. Red soils are also acidic and deficient in humus. Tarai soils also lack humus.

14.3.10 VEGETATION

The vegetation is semi-deciduous;forestcontains the first canopy dominated by deciduous species, whereas second is dominated by evergreen species. The riparian forest is characterized by an Acacia- Dalbergia. The LGP is very rich in swampy mangroves forests. This is known as Sundrebans because of the dominantmangroves species called Sundari. The mammal fauna

consist of 126 species including the endemic species of bat. The aquatic fauna consist of about 300 species of fishes.

14.3.11 FAUNA AND FLORA

This Lower Ganga Plain is a home for 126 native species. They include threatened species like Asian elephant, Tiger, Gaur, Sloth bear, Smooth-coated otter, Chausingha, Great Indian Civet. The Lower Ganga Plain is home for more than 380 species of birds. Lesser florican, Fish-eagle, Swamp francolin, IndianGrey Hornbill, Oriental Pied Hornbill, Bengal Florican.

14.3.12 AGRICULTURE AND AGRO BIODIVERSITY

These are man-made fertile plain formed by clearance of forests. The major crops are rice, jute and horticulture crops. Fishing is also a major source of food. The moisture availability throughout the year permit the triple-cropping system: **Rainy or Kharif season** (June to October), **Winter or Rabi season** (November to February), **Summer or dry season** (March to May). Mainly the region is rice growing region. Pulses are also grown like peas, lentil or chicken pea. Jute is another major crop and more than 85% of the world is from this region. Jute cultivation is divided into three areas: 1) **Brahmaputra Alluvium or Jat Area** produces the best quality of jute having acidic soil. 2) **Ganges Alluvium or DistrictArea** having alkaline soil and produces next order of quality of jute, 3) **Teesta Silt or Northern Area** has sandy soil thus produces the inferior quality of jute. The major cropping systems in the area are: rice-wheat, rice- potato, jute-wheat, jute-wheat, jute-rice-sunflower, jute-mustered, jute-rapeseed-rice, sesame-groundnut-sunflower, pulses-wheat, rice-vegetables, rice-wheat-summer rice. Availability of moisture throughout the year permits the fruit cultivation like, banana, coconut, mango, papayaetc. Fishing is also an important activity of the delta region (Singh, Parkash, Singhvi, 1998).

14.3.13 SOCIAL AND CULTURAL LIFE

As per 2021 census, total population is 8,01,76,1977 out of which male are 4,14,65,985 and female is 3,87,10,212. Lower GangaPlain records 26.3 per cent of Population growth with

population density of 904 per sq km. Region registered the sex ratio of 934 of females per 1000 males. Literacy rate of male is 77.58% and females of 60.25%. (Census, 2021) The languages are mainly Indo-Aryan. Today Hindi and Urdu are the major languages of this region. There is in addition a great variety of regional languages like Bangali, Maithali, Punjabi etc. Both Hinduism and Islam are the major religion with Sikhism, Buddhism and Jainism are also main religion of Lower Ganga Plain. During festivals season's more than 70 million people bathe in Ganga to clean their past sins, which is also an account for its pollution. The tribes living in the region are: 1) Aboriginal tribes: Garo, Bumiji, Chakma, Kol,Khasi etc. 2) Semi-Hinduised Aboriginals: represented by Bauri, Bind, Bhuiya, Chamar or Muchi, Chandal etc.

14.3.14 ECONOMY

Around two-third population of the Lower Ganga Plain work in agriculture and grow crops in the fertile land of Ganga Brahmaputra delta. The major crops are jute, tea, rice. Fishing is also a major economic activity. Government has helped the Lower people of Ganga Plain to improve fish production. Green Revolution has also proved to be one of the major steps to develop the crop production (Ahir, 2007b).

14.3.15 PROBLEMS AND PROSPECTS

Challenges that people of LowerGanga Plain in coming yearswill face the threat of increasing sea level due to climate change so there is need that more research should be conducted for the management of coastlines. The dense population, increasing industrialization and agriculture posses the threat for the forest of Lower Ganga Plain. Conversion of forest land into agriculture land is also a serious problem and need to carry conservation approach. Aquaculture, and excess fishing and harvesting timber and firewood are some of the alarming threats for the region. Fishes are the major consumable food among the masses. Thus fish farming needs to be promoted. Forest clearance has accelerated during the last century, and it is estimated that during the end of the century only 3% of the natural forest will remain. The left over forest are in the small patches. The World Wild Fund identified over 40 protected areas or 7010sq.kms. in the Lower Ganga Plain for the protection of endangered animal and bird species.

14.3.16 SIGNIFICANCE OF THE LOWER GANGA PLAINS

The Great Lower GangaPlain of India has been the repository of the Indian culture. This is covered with one of the most productive soil of the world. Its soil has the capacity to grow any crop of the tropical and temperate regions. The main points of significance of the Great Ganga Plain of India are as under:

1. The soils of the plain are agriculturally most fertile. They are termed as "Granary of India".
2. Most of the rivers traversing the Lower Ganag Plain of India are perennial in nature. A number of canals have been carved out of these rivers which makes agriculture more remunerative and sustainable.
3. They rivers of Lower Ganga Plain have verygentle gradients which makes them navigable over long distance.
4. The Lower Ganga Plain has a rich underground water-table which is being utilized through tube-wells and pumping sets of irrigation.
5. Development of infrastructure like roads and railways could become easy in the plain.
6. The sedimentary rocks of plain have petroleum and natural gas deposits.
7. The plainconstitute less than one-third of the total area of the country, but support over 40% of the total population of the country.
8. The Lower Ganga Plainhas witnessed several religious, political, cultural and social movements. Some of the great religions of the world, like Hinduism, Buddhism, Jainismetc have their origin in the Great Plain of India. Several sacred places and centers of Pilgrimage (Allahabad, Varanasi, Bodh-Gaya, Patna Sahib etc) are situated in the plains. (Husain, 2008c)

14.4 SUMMARY

The Lower Ganga Plain extends from Patna in the West to Sunderban Delta in the east. The lower Ganga Plain (LGP) of the Indo-Gangetic Plain is the extension of the Middle Gangetic Plain (MGP) to the southeast, and is particularly characterized by its greater humidity. Its extension is 24^0 2' N 89^0 35' E, comprises of countries like Bangladesh, India, Mayanmar and states of Assam, Bihar, Odisha, Tripura, Uttar Pradesh and West Bengal. Physically LGP is made up of three major regions:**1) Brahamputra Alluvium**: comprises of the Dhaka, Tangail

and Comilla of Bangladesh. 2) **Ganges Alluvium:** comprises of Kushtia, Jessore, Khulna, Rajshahi, Pabna and Dhaka of Bangladesh. 3) **Teesta Silt**: includes parts of Rangpur district, East Bogra and Sirajganj of Bangladesh and parts of West Bengal. The LGP in India consists of four plains:1) **Barind Plains West Bengal:** Comprises of Dinajpur, Maldah.**2) Central Alluvial Plain:** Nadia, Bardhman, Hoogly, Howrah, Murshidabad, Medinipur. **3) Alluvial Coastal Saline Plains:** North and South 24 Paraganas and **4) Rorh Plains:** Bankura and Birbhum. The Brahmaputra, from northeast to the south and merges with Ganges, and Meghna towards the south meets with Padma and ends in to the Bay of Bengal. Thus the eastern part of the plain is drained by the Tista, Jaldhakia, Sankosh joining the Brahmaputra and the western part is drained by the Mahananda, Ajay and Damodar. The Lower Ganga Plain has laterite, red and alluvial soils.There is Sundrebans delta because of the dominant mangroves species called Sundari. The mammal fauna consist of 126 species including the endemic species of bat. The aquatic fauna consist of about 300 species of fishes. Lower Ganga Plain is a home for 126 native specieslike Asian elephant, Tiger, Chausingha etc. 380 species of birds like Lesser florican, Fish –eagle, Indian Grey Hornbill, Bengal Florican etc. Triple cropping system is possible: **Rainy or Kharif season** (June to October), **Winter or Rabi season** (November to February), **Summer or dry season** (March to May). Mainly the region is rice growing region. Pulses are also grown like peas, lentil or chicken pea etc. Jute is another major crop. Jute cultivation is divided into three areas: 1) **Brahmaputra Alluvium or Jat Area** produces the best quality of jute having acidic soil, 2) **Ganges Alluvium or District Area** having alkaline soil and produces next order of quality of jute and 3) **Teesta Silt or Northern Area** has sandy soil thus produces the inferior quality of jute.As per 2021 census, total population is 8,01,76,1977 out of which male are 4,14,65,985 and female is 3,87,10,212. 26.3 percent is Population growth and population density of 904 per sq kms. Region registered the sex ratio of 934. Literacy rate of male is 77.58% and females of 60.25%. Both Hinduism and Islam are the major religion with Sikhism, Buddhism and Jainism is also there with tribal population like Garo, Bhuri etc. Around two-third population of the Lower Ganga Plain work in agriculture. The dense population, increasing industrialization and agriculture posses the threat for the forest of Lower Ganga Plain. Conversion of forest land into agriculture land is also a serious problem and need to carry conservation approach.

14.5 GLOSSARY

Alluvium Terraces: A relatively level plain or step that is formed by the deposition of alluvial sediments in floodplains when water velocities are reduced as the river subsides from a high flow event.

Bluffs: A steep shoreline slope fromed in sediment (loose material such as clay, sand and gravel) that has three feet or more of vertical elevation just above the high tide line.

Delta: wetlands that form as rivers empty their water and sediments into anther body of water, such as an ocean, lake, or another river.

Detrital Material: Particles of rocks derived from pre-existing rock through weathering and erosion.

Flood Plains: A floodplain is a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley.

HFF: Himalayan Front Fault
LabyrithnChhanels: a maze (as in a garden) formed by paths separated by high hedges.

Levees: A low wall built at the side of a river to prevent it from flooding.

LGP: Lower Gang Plain

Ravines: A geographical feature that are characterized by steep-sided, narrow valleys or gorges that are formed by the erosion of water.

Riverine Delta: Riverine delta is a landform shaped like triangle, created by the deposition of sediments that is carried by a river and enters slower moving or stagnant body.

Swamps: A swamp is a wetland permanently saturated with water and dominated by trees. There are two type of swamps; freshwater swamps and salt water swamps.

14.6 ANSWER TO CHECK YOUR PROGRESS

1. The Ganga plain is separated by the Himalayan Front Fault.

2. The Ganga plain is formed by the confluence of the Ganges, Brahmaputra and Indus rivers.
3. The Great Plain extends 24 kilometres in length from west to east.
4. The slope of Ganga plain is found to be 15 centimetres per kilometre.
5. The Ganga plain extends over an area of 1400 kilometres from west to east.
6. Ganga plains are divided into Bhabar, Terai, Khadar, Bangar and Bil plains.
7. The world's only beautiful forest is found in the Ganga plains.
8. More than 380 species of animals are found in the Ganga plains.
9. The main crop of Ganga plain is wheat, rice and jute horticulture.
10. The population density of Ganga plain is 904 persons per square kilometres.

14.7 REFERENCES

1. Ahir, R. (2007a). Geography, Spectrum Books Publication Pvt. Ltd. (New Delhi), Pp. 445-446.

2. Ahir, R. (2007b). Geography, Spectrum Books Publication Pvt. Ltd. (New Delhi), P. 450.

3. Census, 2011. Census of India, StatitsticalAbstarct of Bhiar, Odhisa, West Bengal, Tripura, 2011.

4. Google Images (a): The Great Plains of India, Retrieved on 12, May, 2023. https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.researchgate.net%2Ffigure%2FThe-Indo-Gangetic-Plains-and-location-of-archaeological-occurrences-mentioned-in-the-text_fig2_227183094&psig=AOvVaw3Gkk1HaGqvzicA8S0WAdbd&ust=1685282001949000&source=images&cd=vfe&ved=0CA4QjRxqFwoTCNiq_uHTlf8CFQAAAAAdAAAAABAa

5. Google Images (b): The Meso-regions of the Northern Plains of India, Retrieved on 12, May, 2023. https://lotusarise.com/wp-content/uploads/2021/02/Divisions-of-Indo-Gangetic-Brahmaputra-Plains-1024x668.jpg

6. Google Images (c): The Location and Extent of Lower Ganga Plains of India, Retrieved on 12, May,2023, https://ars.els-cdn.com/content/image/1-s2.0-S0341816298000666-gr3.gif

7. Google Images (d): Drainage System of Lower Ganga Plain of India, Retrieved on 12, May,2023, https://upload.wikimedia.org/wikipedia/commons/thumb/3/34/Ganges-Brahmaputra-Meghna_basins.jpg/500px-Ganges-Brahmaputra-Meghna_basins.jpg

8. Hussai, M. (2008a). *Geography of India*, McGraw Hill Education (India) Private Limited, p. 2.21.

9. Hussai, M. (2008b). *Geography of India*, McGraw Hill Education (India) Private Limited, pp. 2.24-2.29)

10. Hussai, M. (2008c). *Geography of India*, McGraw Hill Education (India) Private Limited, p. 2.30.

11. Singh, L.P., Prakash, B. and Singhvi, A.K. (1998). Evolution of the Lower Gangetic Plains Landforms and Soils in West Bengal, India, Catena, pp. 776-104.

14.8 TERMINAL QUESTIONS

A- LONGTYPE QUESTION

Q.1 With a suitable diagram explainsthe physiographic division of Great Indian Plain.

Q.2 Briefly describe the physiographic division of Lower Ganag Plain with suitable diagram.

Q.3 Examine the Drainage system, agriculture and Problem Prospects of the Lower Ganag Plain.

Q.4 Discuss the socio economic life and Significance of Lower Ganga Plain. .

Q.5 Discuss in brief the Flora, Fauna and Climate of Lower Ganga Plain.

B- SHORT TYPE QUESTIONS

Q.1- Briefly describes the physiographic divisions of India?

Q.2- Describe the great plains of India?

Q.3 Briefly describe the land forms of the Ganga plains.

Q.4-Explain the social and cultural aspects of Ganga plains.

Q.5- What is the usefulness of Ganga plain for human life?

Q.6- Write a short note on the biodiversity of Ganga plains?

Q.7- Explain about the soils of the Greater Ganga Plain?

Q.8- Divide the Ganga plain into agro climatic zones?

C- MULTI CHOICE QUESTIONS

Q.1- Where does River Ganga originates from?

A. Gangotri

B. Yamnotri

C. Bhagirathi

D. Bandarpuch

Q.2- Where is Lower Ganga Plain located?

A.North to south.

B. West to East.

C. South to West.

D. South East.

Q.3- The Lower Ganga plain is formed by the rivers?

A. Ganga

B. Brahmaputra

C. Ganga & Brahmaputra

D. Narmada &tapi

Q. 4- From which soil is the Lower Ganga plain formed?

A. Red soil

B. Alluvial soil

C. Black soil

D. None of the above

Q.5- Into how many parts is lower Ganga plain divided on the basis of physiographic division?

A. 6

B. 5

C. 4

D. 7

Q.6- What is the average width of the Great Plains of India?

A. 400 Kms

B. 300 Kms

C. 500 Kms

D. 700 Kms

Q. 7- What is the extent of Lower Ganga Plain?

A. Patna to Sundarban Delta

B. Uttar Pradesh to Bihar

C. Haridwar to Uttar Pradesh

D. Gangotri to West Bengal

Q.8- Lower Ganga plain is divided into how many agro climatic zones?

A. 5

B. 6

C. 3

D. 8

Q.9- How many types of vegetation are found in the Lower Ganga plain?

A. 125

B. 126

C. 127

D. 128

Q.10- What percentage of India's population lives in the Lower Ganga plains?

A. 50%

B. 40%

C. 60%

D. 70%

Q.11West-east extent of Great Plains of India is

a) 1200 kms b) 1400 kms

c) 1800 kms d) 1300 kms

Ans.1 **b)**The west-east extent of Great India Plains is 1400 kms.

Q.12 Which among the following pairs of crops is the most suitable for this region?

a) Paddy and Cotton b) Wheat and Jute

c) Paddy and Jute d) Wheat and Cotton

Ans. 2 **c)** Paddy and Jute

Q.13 Best quality of Jute is produced by

a) Jat Area b) District Area

c) Northern Area d) Tista Silt

Ans. 3 **a)**. Jat Area/Brahmaputra Alluvium

Q.14 What is the west-east extent of Great Indian Plains?

a) 1200 kmsb) 1400 kms

c) 1500 kms d) 1300 kms

Ans. 4 b) 1400 kms

Q. 15 1) Delta formed by Lower Ganga Plain is

a) Arcuate Delta b) Crescent Delta

c) Estuarine Deltad) Bird Foot delta

Ans.5 a) Arcuate Delta

Q. 16 Sunderban Deta is formed by

a) Upper Ganga Plains b) Middle Ganga Plain

c) Lower Ganga Plain d) Peninsula India

Ans. 6 c) Lower Ganga plain

Q.17 What are the growing days in Lower Ganag Plain

a) 160 to 245 days b) 150 to 270 days

c) 180 to 280 days d) 140 to 230 days

Ans.7 b) 150 to 270 days.

Q.18 What is the Female Literacy rate of Lower Ganga Plain, according to census 2021?

a) 65.86% b) 56.78%

c) 75.98%d) 60.25%

Ans. 8 d) 60.25%

Q. 19 Agricultural months (June to October)

a) Rabi Crops b) Zaid Crops

c) Kharif Crops d) Summer Crops

Ans.9 c) Kharif Crops.

UNIT 15 CHOTA-NAGPUR PLATEAU

15.1 OBJECTIVES

After having the detailed study of this unit you will be able to

- Know the extent and origin of Chota-Nagpur Plateau.
- Understand in detail the physiographic division of Chota-Nagpur Plateau.
- Understand in brief the socio-economic conditions of Chota-Nagpur Plateau.
- Discuss the problem and prospects and Significance of the region.

15.2 INTRODUCTION

Present unit deals with physiographic and morphological study of Chota-Nagpur Plateau. Unit starts with the formulation of few objectives as mentioned above. According to these objectives the study is conducted. Firstly the major geological formations of Indian Peninsula are seen: a) The Archaean Group, b) The Dharwar System, c) The Cuddapah System, d) The Vindhiyan System, e) The Gondwana System,f) The Deccan System, g) The Deccan Trap, h) The Tertiary System, and i) The Pleistocene Period. After that physiographic divisions of peninsular India are also seen:1) The North Central Highlands, 2) The South Central Highlands, 3) The Chota-Nagpur Plateau, 4) The Meghalaya-Mikir Uplands, 5) The North Deccan, 6) The South Deccan, 7) The Western Ghats or Sahayadri, and 8) The Eastern Ghats. Among these the detailed study of Chota-Nagpur Plateau is conducted. Origin of Chota-Nagpur Plateau is worked out and then the detailed study of surface features, landforms, extent and socio-economic conditions of the Chota-Nagpur Plateau is carried. It is registered that Chota-Nagpur Plateau is divided into three steps. The first step or highest part is consisting of western part known as Pats, the second or medium part consists of Hazaribagh and old Palamau district and the lowest part consist of Manbhum and Singhbhum district. Further the Chotanagpur plateau at meso and micro regions is divided into six divisions namely 1) Pat Region, 2) Ranchi Plateau, 3) Hazaribagh Plateau, 4) Damodar Trough and 5) Palamau Plateau and 6) Manbhum nad Singhbhum. Detailed study of each region is taken one by one. Further the brief description of climate, rivers, vegetation, wildlife and socio-economic life of Chota-Nagpur Plateau is done. In the last Problem and Prospects and significance of the Chota-Nagpur plateau is also worked out. A short

Summary of Chota-Nagpur plateau is cited at the end. After the short Summary, Glossary and References are also cited and finally unit ends with some terminal questions.

15.3 DETAILED STUDY OF CHOTA-NAGPUR PLATEAU

The Chota-Nagpur is a continental eastern Plateau of peninsular India. It sprawls over parts of Western West Bengal, Jharkhand, Chhattisgarh, Odisha and north-eastern part of Andhra Pradesh. The Chota-Nagpur Plateau has the most valuable concentration of minerals and is a most important industrial region of India. The plateau has been established by continental uplift from forces acting deep inside the earth.

15.3.1 MAJOR GEOLOGICAL FORMATIONS OF THE PENINSULAR INDIA (ABOUT 3600 MILLION YEARS AGO)

The plateau of peninsular India exhibits a complex system of geological structures. The major rock systems found in the peninsular India have been given below:

a) The Archaean Group
b) The Dharwar System
c) The Cuddapah System
d) The Vindhiyan System
e) The Gondwana System
f) The Deccan System
g) The Deccan Trap
h) The Tertiary System
i) The Pleistocene Period

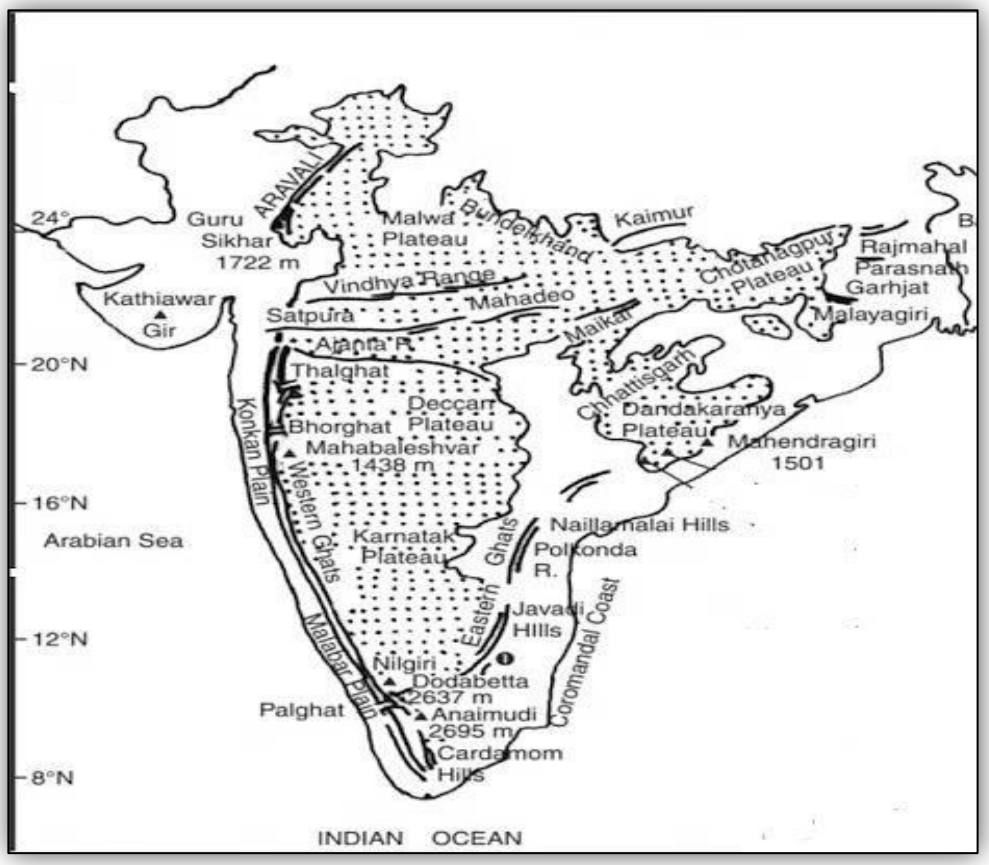
15.3.2 THE PHYSIOGRAPHY AND RELIEF FEATURES OF PENINSULAR INDIA

Covering an area of about 16 lakh sq kms, the peninsular upland forms the largest physiographic divisions of India. With a general elevation between 600-900 mts, the region constitutes an irregular triangle with its base lying between the Delhi Ridge and the Rajmahal Hills and the apex formed by Kanayakaumari (Khullar, 2003).

Physiographic Regions of Peninsular India

1. The North Central Highlands
2. The South Central Highlands
3. The Chota-Nagpur Plateau
4. The Meghalaya-Mikir Uplands
5. The North Deccan
6. The South Deccan
7. The Western Ghats or Sahayadri
8. The Eastern Ghats

Fig: 15.1 Physiographic Regions of India



Source: Google Images

15.3.3 ORIGIN OF CHOTA-NAGPUR PLATEAU

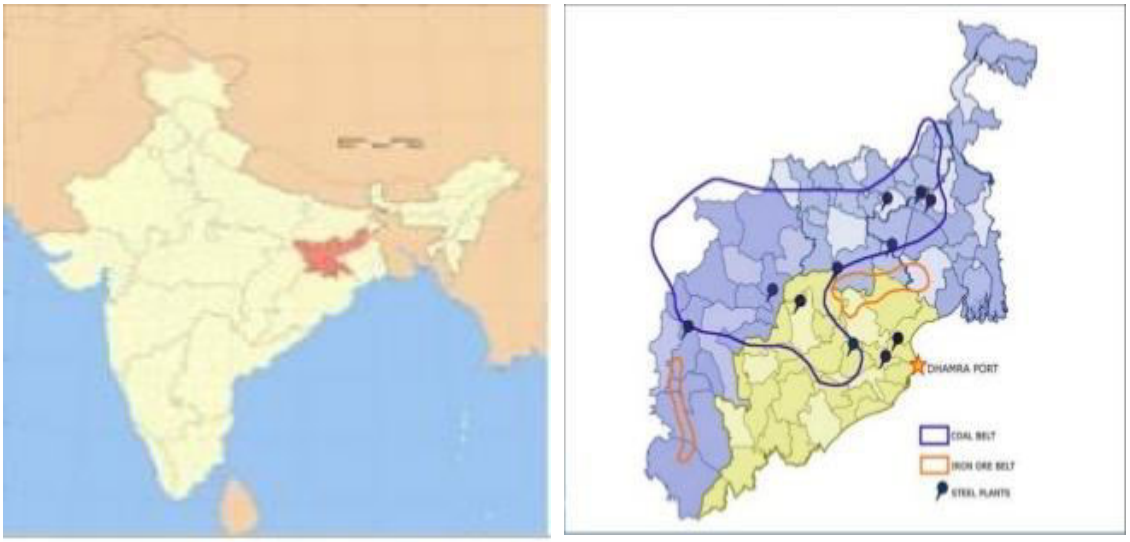
The origin of rocks of Chota-Nagpur plateau is more than 3600 million years old. Before the carboniferous period, it was a part of the Gondwanaland. In the opinion of geologists, during the Archean period, the Chota-Nagpur Plateau never subsided under the sea permanently. It was more rigid, stable, hard and remained almost unaffected by the mountain building forces. However it is experienced block faulting and displacement during the subsequent periods as evidenced by the Dharwar and Gondwana formations and the Fault valleys of the Narmada, Tapi and Son rivers. It was during Carboniferous Period that coal was formed in the Damodar, Son, Mahanadi and Godavari basins. During the Cretaceous Period, large scale volcanicity produced the Deccan Trap (the Lava Plateau of India), comprising lava sheets of several thousand meters in depth. The Deccan trap originated about 14 million year back when the magma flowed from the depth of about 40 kms below the crust. The ancient origin of Chota-Nagpur Plateau can be dated back to the separation of Gondwana land. During cretaceous period, it broke and got free from the Gondwanaland and now it is the part of the Deccan Plateau. It is composed of Achaean granite and Gneiss rocks with patches of Dharwar (mica-schists), the Damuda series of the Gondwana Period, and the lava flows of the Cretaceous Period (Hussain, 2008a).

15.3.4 PHYSIOGRAPHY OF THE CHOTA-NAGPUR PLATEAU

In Chota-Nagpur Plateau, the name “Nagpur” has been derived from the word Nagavanshis, who were the rulers of the Nagavanshi Dynasty of Odisha. The word “Chota” is derived from the name of a village in the outskirts of Ranchi, which has the remains of fort of the Ngavanshi (Ahir, 2007a).

The Chota-Nagpur Plateau is a plateau in eastern India, which is sprawl over parts of west Benagal, Jharkhand, Chhatisgarh, Odisha, north-eastern part of Andhra Pradesh. Among these states Chota-Nagpur covers much of the Jharkhand state. The total area covered by Chota-Nagpur Plateau is approximately 65,000 sq kms. and height from 1100 m to 3000 m. The Chota-Nagpur Plateau extends from 22^{0} N to 25^{0} 30’ N and 83^{0} 47 E to 87^{0} 50’ E. It is the store house of minerals like copper, bauxite, mica, limestone, iron ore and coal. The Chota-Nagpur Plateau is bounded by Indo-gangetic plains to the north and east of plateau and in the south by the Basin of Mahanadi River.

Fig: 15.2 Physiography of the Chota-Nagpur Plateau



Source: Google Images

Further it is bounded by Ranchi Plateau in the south, the Hazaribagh Plateau in the north and the Rajmahal Hills in the north-east. Important rivers are Damodar, Son, Bokaro, Subernrekha, Kanchi, Gaya, koel, Karo, Raru, Liajan, Sankh etc. Important cities are Jharia, Raniganj, Bokaro, Karanpura, Jamshedpur, Ramgarh, Asansol, Durhapur, Bardhman, Ranchi, Ramgarh etc.

Chota-Nagpur Plateau region is economically and ecologically important. It has the most precious concentration of mineral resources. Damodar valley has world famous coal reserves and Hazaribagh is known for mica reserves. Minerals such as bauxite, iron ore, limestone, asbestos and apetite are also found in good concentration. Jamshedpur and Bokaro is two important Industrial region of Chota-Nagpur Plateau. Deciduous forest spread over Jharkhand, Orissa, Bihar, Chhatisgarh are ecologically most important resource. Chota-Nagpur Plateau consists of three steps. The western part of the plateau consist of **highest part** and locally known as Pats with 910 to 1070 mts above sea level consist of highest point of 1164 mts. **The next part** comprises of large portion of Hazaribagh, old Ranchi and some parts of old Palamu districts with average height of 610 mts having gneissic hills. **The lowest step** of the plateau is at an average height of 300 mts. It comprises of Manbhum and Sighbuhum districts. The highest hills are Parasnath Hills 1,370 mts and Dalma Hills 1038 mts (Ojha, 2007a).

This plateau has a series of meso and micro plateaus as Ranchi, Hazaribagh, Singhbhum, Dhanbad, Palaamu, Santhal, Parganas, and Purulia districts of West Bengal. There are seven plateau having different nature and characteristics:

1. Pat Region
2. Ranchi Plateau
3. Hazaribagh Plaetau
4. Koderma plateau
5. Damodar Trough
6. Palamau Plataeau
7. Manbhum and Singhbhum

1) Pat Region: Flat topped plateau locally known as Pat. Pat is the highest point of about 3500 ft above mean sea level in the western part of the Chota-Nagpur plateau. Pat covers the north-western part of the Ranchi district and southern edge of Palamau Plateau. Pat region consist the dissected hills of Deccan lava which later changed into lateritic and bauxite due to chemical and physical change. Example Jamira Pat, Rudni Pat, Khamar Pat, Netarhat Pat.

2) Ranchi Plateau: Largest part of Chota-Nagpur Plateau covers almost whole of the Ranchi Plateau with average elevation of 700 mts. Ranchi Plateau is highly dissected and slopes down towards south-east into a hilly undulating region of Singhbhum. Damoadar River originates from these hills. The Damodar River separates upper Hazaribhagh Plateau in the north and plateau (Pat) in the west. There are many waterfalls like Hundru Falls of about 75 mts on Subarnarekha River near Ranchi, Sadni Falls of 60 mts on Sankh River and Dassam Falls of 39 kms on the Kanchi River. Ranchi Plateau also has hanging valleys like Rajrappa fall of 10 mts, the Bhera River coming over Damodar River. Another such example is Jonha Falls etc.

3) Hazaribagh Plateau: It comprises of gneisses and Dharwar rocks. Hazaribagh Plateau is divided into two parts: the higher plateau and lower plateau. Higher plateau is Hazaribagh Plateau and the lower plateau is Koderma Plateau. Hazaribagh Plateau is narrows towards the west and descends slowly and joins with Simaria and Jabra where it curves and connects with the Ranchi Plateau through Tori Targana. Whereas Koderma Plateau looks like range of hills but in real they are edge of plateau. Kasiatu, Heasiatu and Hudu (600 mts) spur like Aswa Pahar (751

mts), Jilinga Hills (932 mts), Mahabar Hills (666 mts), Jarimo Hills (666 mts), Barsot (660 mts), Sendraili (670 mts), Mahuda (734 mts) etc.

4) Koderma Plateau: The Koderma Plateau referred as Hazaribagh lower plateau. It is 240 mts above the Gaya. Koderma Plateau acts as watershed between Barakar River and Gaya. The eastern slope meets with Santhal Pragnas and diapers in the lower plains of Bengal. The drainage to the south of this Koderma Plateau passes by Jamunia River.

5) Damodar Trough: The Damodar forms a trough between Ranchi and Hazaribagh Plateau. The northern boundary of plateau is steep and meets with Hazaribagh Plateau. On the south of the trough, Damodar is close to the Ranchi Plateau. In the east Doamodar River passes into the Manbhum sector.

6) Palamau Plateau: The Palamau Plateau lies at a lower height than the surrounding region of Chota-Nagpur Plateau. In the east it reaches up to Ranchi Plateau and the southern part merges with Pat Region. On the west of Palamau Plateau are the Surguja highlands and Sonbhadra district of Uttar Pradesh. In north-western part, there is Son River. Through these Palamau Plateau, the North Koel River passes. In the southern portion of these hills are cup like valley Chhechhari Valley surrounded by hills from all side. Lodh Fall is the famous fall of Palamau Plateau.

7) Manbhum and Sighbhum: Manbhum and Singhbhum are the lowest part of Chota-Nagpur Plateau. Manbhum cover the area of Purilia district in West Bengal, Dhanbad district and Boakro in Jharkahnd. This region has elevation of about 300 mts and consists of Baghmundi and Panchkot hills. Sighbhum covers the Kolhan division of Jharkhand. It is hillier than Manbhum. Centre of the Singhbhum district is upland plateau having fertile land and have Saranda Forest (Husain, 2008 b).

15.3.5 INDUSTRIAL REGION

Industrial region appears when a number of industries locate close to one other and share the benefits. Thus they locate at one place due to some favorable factors. In India there are several industrial regions and Chota-Nagpur Industrial region is one of the most important Industrial Region. Chota-Nagpur Plateau is the store house of various minerals as Bauxite, Copper, Iron ore, Mica, Limestone, coal. Damodar valley is rich in Coal and 80% of India's

known coal deposits belong to Damodar Valley region. Apart from these, mineral like asbestos, pyrites, apatite, chromites etc are found in Sighbhum region and not only this, atomic minerals like uranium is also mined in Jadugora region. Power requirement is from thermal and hydel power plants constructed over Damodar River. Densely populated nearby region of Chota-Nagpur Plateau provides the cheap labour. Hoogly region serves as a good Market for the consumption of finished products. Heavy engineering industries like fertilizers, cement, paper, locomotives, and machine tools are some of the important industries of Chota-Nagpur Plateau. Important centers are Bokaro, Rourkela, Asansol, Durgapur, Dhanbad, Ranchi, Jamshedpur etc.

Topography of Chota-Nagpur Plateau

Chota-Nagpur plateau is the most unique physiographic unit characterized by undulating and rolling topography. The elevation varies from 598 m near the outlet to more than 793 m in the hills of the Kokdoro village. The average slope varies from 1 to 5%.

15.3.6 CLIMATE OF CHOTA-NAGPUR PLATEAU

Climate of Chota-Nagpur Plateau is mainly tropical with hot summers and cold winters. The annual rainfall is 1400 mm, which is less than the rainforest regions of India. The rainfall received in plateau is mostly by the monsoonal rainfall between the month of June and August. Climate is tropical monsoon type having three distinctive summer months (March to mid June), Monsoon (mid June to October), and Winter (November to February). May is the hottest month with temperature 45 ^{0} C whereas January is the coldest month experiencing the lowest temperature of 6 ^{0} C. For five to six months of the year from October onwards the days are bracing and sunny. The mean temperature is 23 ^{0} C. The nights are cool and temperature in winter may drop down to even less than the freezing point. In April and May, day temperature is more than 38^{0} C. From June to September, the climate is pleasant. Wind velocity is varies between 2.2 kms/hr to 6.56 kms/hr. During summer specially in June wind velocity is highest and lowest in winters. During May and June, the region experiences hot winds Known as the Loo. During monsoon season wind velocity again increases and this adds the rate of soil erosion caused by rainfall. Rainfall in Chota-Nagpur Plateau is high intensity rainfall in short duration of time period. Mean annual rainfall is 1501 mm spread over 21 weeks. Mean monthly relative humidity ranged between 38% (April-May) to 91% (August-September). Rainy season has highest humidity, followed by winter and hot summer season.

15.3.7 RIVER SYSTEM OF CHOTA-NAGPUR PLATEAU

Chota-Nagpur Plateau is present between the basins of the Ganga and Son rivers to the north and the Mahanadi River to the south. Through its centers, from west to east, runs the coal-bearing, faulted Damodar River Valley. River Mahanadi has made the Chota-Nagpur Plateau a wide and fertile plain. Number of tribal people still inhibits the Bastar region. In Between the Narmada and Krishna River lies the Central Plateau. Damodar River drains the Chota-Nagpur Plateau. The Damodar River flows on the Chota-Nagpur Plateau dividing it into two plateaus- the Hazaribagh Plateau and the Ranchi Plateau. After flowing into the upland, it comes down and meets Hugli River in West Bengal.

15.3.8 SOIL

The plateau has mainly red soil that is derived from rock formation. The common soils are red and yellow, fine loamy to clayey, non-calcareous with slight to moderate acidic in nature. In general soil is light to medium texture and varies between sand clay loam at the surface and clay loam at the 30-60 cms soil depth of soil profile. The soil exhibits a high percentage of acid-soluble ferric oxide and lower pH value of 5 to 6.8. The soil can be divided into: **Red soil** found in Damodar Valley and Rajmahal area **Micacious Soil** (containing particles of mica) found in Koderma, Jhumritalaiya, **Sandy soil** found in Hazaribagh and Dhanbad, **Black Soil** found in Rajmahal area, **Laterite Soil** found in western part of Ranchi, Santhali Paragana and Singhbhum. Laterite soil is acidic in nature so it is not suitable for agriculture and is known as **Usar** land. The soil of Chota-Nagpur Plateau is dry for 90 days and mean annual temperature of soil is 22^0 C (Ojha, 200b). Watershed is divided into five classes: 1) Upland Left (UL), 2) Upland Right (UR), 3) Medium Land Left (ML), 4) Medium Land Right (MR) and 5) Lowland (LL).

15.3.9 AGRICULTURE

Agriculture of Chota-Nagpur Plateau is very old. It has Chalcolothic period extending from Ganga basin to Chota-Nagpur Plateau. Copper and Bronze tools recovered from Chota-Nagpur Plateau shows that agriculture is practiced from the time of early human settlement. Chota-Nagpur Plateau found in receives good rainfall but productivity of crops in the region is very poor, because of undulating slope terrain, non-availability of irrigation facilities, poor water

and soil conservation. Agriculture is mainly depends on rainfall and here rain fed agriculture is practiced and major crop is rice which is preferred by progressive farmers having accessibility for irrigation facilities. Cropping pattern is transitional, with mixture of wet and dry crop. Rice is the dominant crop in whole of Chota-Nagpur Plateau. Whereas supplementary crop are wheat, barley, minor millets, oilseeds, pulses, vegetables like brinjal, capsicum, cucurbits etc, and fruits like guava, jamun, and mango are grown. 33 plant species of leafy vegetables grown by tribal people have medicinal value. The Chota-Nagpur Plateau experiences three distinct agricultural seasons: Kharif (May – October) rice, maize, millets, brinjal etc are grown. Rabi (November – February) wheat, mustard, potato are grown and Zaidi (March-May) Kadu, Kohra, ladyfinger, Frech Beans are grown. But the most common cropping pattern is rice-fellow. Cultivation of Mahau is also very common crop and fruits are mainly used for alcohol formation (Ojha, 2007c). Chota-Nagpur Plateau have three major harvests in the year: **Bhadai**: Bhadai extends from May to June and dominated by barley crop. Barley is harvested in **Bhado**. This harvest period extends from (August- September). Aghani: In this the rice is sown from mid of June month and this Gathered in month of December known as **Aghan**. The rabi mainly the wheat crop that ripens in spring.

15.3.10 ECOLOGY

Climate of Chota-Nagpur Plateau is humid and sub-humid, having hot summers and cool winters. Tropical and sub-tropical dry broadleaf forests encompass dry deciduous forests found in Hazaribagh Plateau and the rainfall is below 125 cms. Plants species like Amalas, Seman, Asan etc. mixed with Bamboo are found. At the higher attitude shoal type forests are found and have species like phoenix, robusta. There is three main type of vegetation; 1) Tropical Moist Deciduous Forest, 2) Northern tropical Dry Deciduous Forest, and 3) Central Indian Subtropical Hill Forest.

15.3.11 FLORA AND FAUNA

Due to geological diversity Chota-Nagpur Plateau is very diverse in flora and fauna. Forest of Chota-Nagpur Plateau has enedemic species. During the geological time period Chota-Nagpur Plateau was a link between the Satpura Hills and Eastern Himalayas and this result in easy exchange of species between these two hill regions and thus Chota-Nagpur Plateau is also

recognized as a distinctive geographic region in the Indian Sub-continent by the Royal Botanic Garden. The total vegetation cover is 29.1% out of which 3.19% is under dense forest cover, whereas 11.39% is under medium vegetation cover, 13.76% is open forest and 0.92% is scrubland. There are three major groups of forest vegetation: 1) Tropical moist deciduous forest, 2) Northern tropical dry deciduous forest and 3) Central Indian Subtropical Hill forest. This region has different variety of Sal and Acacia trees. They are mostly attains the height of 25 m tall. In flora species it has Asiatic Elephant, Bison, Bengal Royal Tiger, four horned antelope, spotted deer, Leapord, Black Buck, Chinkara etc. Chota-Nagpur Plateau is comprises of 400 birds species like florican, Indian Grey Hornbill, oriental pied hornbill. About 5 per cent of Chota-Nagpur Plateau is protected area (Nayar, 1996).

15.3.12 SOCIAL AND CULTURAL LIFE

Chota-Nagpur Plateau has diverse ethnic, social, religious and linguistic background. The vast majority of Chota-Nagpur Plateau practice Hinduism, but there are also other minorities like Muslims, Jains, Christians and Buddhists and Sikhs. Chhattisgarhi is the most widely spoken language followed by Hindi and both are official language of Chota-Nagpur Plateau. Gondi, Marathi, Urdu, Oriya, Guajarati and Punjabi are spoken by people of Chota-Nagpur Plateau. Total population of Chota-Nagpur Plateau according to census 2021 is 26945829; out of which male population is 13885037 and female population is 1306092. Population density is 338 sq kms and population growth is 23.19% and sex-ratio is 941. Literacy rate of Chota-Nagpur Plateau is recorded to be 53.56%, while of which male registered 67.30% and Female 38.87%. Further Chota-Nagpur Plateau has no SC population and ST population is 62% (Census, 2011 India) Monda, Oraon, Santhal are the major tribes of Chota-Nagpur Plateau. They live in forest and lead an ignorant life totally detached from the outside world. In the forest they make their huts with mud and consume flesh, rice, fruits. They worship the Sal trees. They have their fairs and festivals as Karam, Tasu, Parab, Hal, Rohin, Sarhul and many more.

15.3.13 ECONOMY

Economy of Chota-Nagpur Plateau is primarily depending on mining, agriculture, energy production and manufacturing. The Chota-Nagpur Plateau has major deposits of iron ore, coal, dolomite and other valuable minerals. Production of rice is from central lowland is known

especially for its abundant production. This plateau is also known for the trade of *tendu* leaves used for the bidis. Chota-Nagpur plateau is also an important supplier of electricity, from both hydroelectricity and thermal projects. Thus the Chota-Nagpur Plateau manufacturing activities focus largely on metal production.

15.3.14 PROBLEM AND PROSPECTS OF CHOTA-NAGPUR PLATEAU

In spite of uniqueness, and biogeographically significance, Chota-Nagpur Plateau's forest and agricultural land is under severe danger because of human-induced activities like mining, settlement, infrastructure development, industrial development, harvest of forest product, overgrazing of pastures, and forest fires, which is causing a serious harm for the biodiversity and agro biodiversity of the area. The forest lands are being lost. Its unparallel biodiversity needs preservation from extinction. There is urgent need to conserve the rich biodiversity of the plateau before it is lost forever. Along with this the soil erosion due to unchecked rainwater runoff is another major issue of the present situation of the region. To preserve the region and its sustainable development there is need of development of suitable rain harvesting methods and improved knowledge on contour binding of the slopes. This would help in sustainable development of agricultural practices. For the better development of rich biodiversity, the several protected areas in the Plateau are developed like, Sanjay Gandhi National Park, Palamau Tiger reserves. This comprises the protected area of about 6720 sq kms. (Kumar, Rawat and Wood, 2011). The number of National Parks and Sanctuaries are developed for the conservation of rich and varied biodiversity of flora and fauna of Chota-Nagpur Plateau.

15.3.15 SIGNIFICANCE OF THE CHOTA-NAGPUR PLATEAU REGION

Richly endowed with natural resources, Chota-Nagpur Plateau has an important role in the economic development of country. The importance of Chota-Nagpur Plateau is mainly due to its location and rock formation.

1. The Chota-Nagpur Plateau is located in between the Ganges and Son River basins in the north and Mahanadi River in the south. The coal-bearing Damodar Valley traverse through its heat.
2. Numerous streams have eroded the uplands, resulting in a peneplain (an area reduced virtually to a plain) with isolated hills.
3. Chota-Nagpur region posses India's most valuable mineral resource.

4. The Chota-Nagpur Plateau region of India is rich in both metallic and non-metallic minerals. Minerals ores like iron, manganese, copper, bauxite, chromium, mica, gold, silver, zinc, lead, mercury, coal, diamond, precious stones, marble, building materials and decorative coal deposits of India are also found in this region.
5. The Hazaribagh area is one of the primary supplier of mica, copper, limestone, bauxite, iron ore, apatite, asbestos etc
6. Baokaro in eastern Jharkhand, is home for thermal power plants and steel Industries.
7. On the southern and eastern parts of Peninsular India large stretches of Archaean, Dharwar, Cuddappah, Vindhyan formation are found in which red, yellow, lateritic soils have developed over time. These soils are the basis of rural economy.
8. Rail and roads cross the Plateau, linking Kolkata in West Bengal to the southeast and Patna in Bihar to the north, as well as towns in the south and west.

15.4 SUMMARY

The Chota-Nagpur Plateau is the part of the Greater Peninsular India. It is 3600 million years old and derived its name from Nagvanshi Dynasty of Odihsha and extend from 22 ^{0} N to 25 ^{0} 30' N and 83^0 47 E to 87^0 50' E. The Chota-Nagpur is a continental eastern Plateau of peninsular India. It sprawls over parts of Western West Bengal, Jharkhand, Chhattisgarh, Odisha and north-eastern part of Andhra Pradesh. In the north it is having Ganag and Son River, in the south there is Mahanadi River and from west to east, there is Damodar River. The Chotanagpur Plateau has the most valuable concentration of minerals in India and most important industrial region of the India. Chota-Nagpur Plateau is divided into three steps. The **first step** or highest part is consisting of western part known as **Pats**. The second or **medium part** consists of **Hazaribagh** and old **Palamau district** and the **lowest part** consist of **Manbhum and Singhbhum** district. Further the Chota-Nagpur plateau at meso and micro regions is divided into six division namely 1) Pat Region, 2) Ranchi Plateau, 3) Hazaribagh Plateau, 4) Damodar Trough and 5) Palamau Plateau and 6) Manbhum nad Singhbhum district. 1) Pat is the highest point in the peninsular India and comprises of Palamau and Ranchi district. 2) Ranchi Plateau covers the largest part of the Chota-Nagpur Plateau and also comprises of Singhbhum District. Damoadar River is found here and has falls like Hundru fall, Saidna fall etc. It comprises of world famous coal reserves. 3) Hazaribagh Plateau: consist of gneisses and other Dharwar rocks.

It comprises of higher plateau Hazaribagh and lower plateau region Koderma Plateau. It is also known as second most important Industrial region of the country. Chota-Nagpur Plateau have tropical monsoon climate with red soils, yellow soil and literate soil as the main soil. Although the region receives the monsoonal rainfall but still there is low crop productivity due to lack of Irrigation facilities. The dominant crop of the region is rice and wheat barley as other supported crops. Tendu levees use in bidi making is produced in this region. It comprises of varied flora and fauna with more than 400 species of birds and Bengal royal tigers and black buck are the important animal species. Chota-Nagpur Plateau is having the vivid picture of social cultural life with mineral exploitation as the main source of economy. The increased mining work and agricultural activity of this region is having threat to the forest and their biodiversity. Government is working on protected areas as National Park and animals reserves.

15.5 GLOSSARY

Gneiss: Gneiss is a common and widely distributed type of metamorphic rock. It is formed by high-temperature and high-pressure metamorphic processes acting on formations composed of igneous or sedimentary rocks.

Micacious Soil: containing parricels of mica

Pats: Flat topped plateau locally known as Pat.

Peneplain: A more or less level land surface produced by erosion over a long period, undisturbed by crustal movement.

Scarp: Steep slope or cliff formed by folded or eroded layer of rock.

Schist's: Schist is medium grade metamorphic rock, formed by the metamorphosis of mudstone/shale, or some types of igneous rock.

Soil texture: Soil texture refers to the size of the particles that makes up the soil.

Spur: A spur is a lateral ridge or tongue of land descending from a hill, mountain or main rest of a ridge.

Usar: Widespread in India and is either saline or alkaline and not suitable for agriculture.

Watershed: watershed is an area of land that drains or sheds water into a specific water body.

15.6 ANSWER TO CHECK YOUR PROGRESS

1. Do you know that the Chota-Nagpur is a continental eastern plateau of peninsular India? It sprawls over parts of western West Bengal, Jharkhand, Chhattisgarh, Odisha, and the north-eastern part of Andhra Pradesh.
2. Do you know that the Damodar River flows on the Chota-Nagpur Plateau, dividing it into two plateaus: the Hazaribagh Plateau and the Ranchi Plateau?
3. The major tribes inhabiting the Chota-Nagpur Plateau are Monda and Santhal.
4. Do you know that the highest mountain peak of the Chhotanagpur Plateau is Parasnath?
5. Chota-Nagpur Plateau plateau is mostly made up of Gondwana rocks.

15.7 REFERENCES

1). Ahir, R. (2007a). Geography, Spectrum Books Publication Pvt. Ltd. (New Delhi), P. 450

2) Census of India, 2011. Census of India, Statitstical Abstarct of Bhiar, Odhisa, West Bengal, Tripura, 2021.

3). Google Images (a): The Peninsular India, Retrieved on 14, May, 2023. https://static.prepp.in/public/image/f380990616bce9589c4ea2288f87febe.png?tr=w-465,h-512,c-force

4). Google Images (b): The Chotnagpur Plateau, Retrieved on 14, May, 2023. https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.gurukulkendra.com%2Fcategory%2Fgeography%2Fpage%2F17%2F%3Fak_action%3Daccept_mobile&psig=AOvVaw3ykfaJlji3VNTN_lUckgPr&ust=1685573017767000&source=images&cd=vfe&ved=0CA4QjRxqFwoTCKjXvoKPnv8CFQAAAAAdAAAAABAE

5) Hussai, M. (2008a). Geography of India, McGraw Hill Education (India) Private Limited, pp. 2.32 to 2.33.

6) Hussai, M. (2008b). Geography of India, McGraw Hill Education (India) Private Limited, pp. 2.35 to 2.37. .

7) Khullar, D.R. (2003). *ISC Geography*, New Delhi, Kalyani Publishers, pp. 23-25.

8) Kumar, P, Rawat, G.S., Wood, P.H. (2011). Diversity and Ecology of (Orchidaceae) in Chotanagpur Plateau, india, Taiwani Paublication, pp.23-36.

9) Nayar, M.P. (1996). Hot Spot of Endemic Plants of India, Nepal and Bhutan, tropical Botanic garden and reaserch Institute, Palode, Thiruvananthpuram, Kerela, india. Pp 249-252. 1996.

10) Ojha, S.K. (2007a). Bharat Ka Bhugol: Indian Geography, Bhaudhik Prakashan, Allahbad, pp. 39-42.

11) Ojha, S.K. (2007b). Bharat Ka Bhugol: Indian Geography, Bhaudhik Prakashan, Allahbad, pp. 43-45.

12) Ojha, S.K. (2007c). Bharat Ka Bhugol: Indian Geography, Bhaudhik Prakashan, Allahbad, pp. 47-48.

15.8 TERMINAL QUESTIONS

A- Long Type Questions

Q.1 With a suitable diagram explains the physiographic division of Chota-Nagpur Plateau.

Q.2 Briefly describe the Agro climate and Ecology of Chota-Nagpur Plateau.

Q.3 Examine the Industrial region and Problem and prospects of Chota-Nagpur Plateau.

Q.4 Discuss the socio economic and significance of Chota-Nagpur Plateau.

Q.5 Discuss the soil, agriculture and Ecology of Chota-Nagpur Plateau.

B- Short Type Questions

1. Where is the Chota-Nagpur Plateau located, and which Indian states does it primarily cover?

2. What are the major rivers that flow through the Chota-Nagpur Plateau and what is their significance for the region?

3. What type of minerals are abundant in the Chota-Nagpur Plateau, and how has mining impacted the region’s economy?

4. Describe the tribal communities that inhabit the Chota-Nagpur Plateau. What is their way of life and cultural significance?

5. How does the Chota-Nagpur Plateau's topography and climate influence its agricultural practices?

C- Multiple Choice Questions

1. Where is the Chota-Nagpur Plateau located primarily?

A. Northern India

B. Western India

C. Eastern India

D. Southern India

Answer: c

2. Which of the following states is not part of the Chota-Nagpur Plateau region?

A. Jharkhand

B. Chhattisgarh

C. West Bengal

D. Madhya Pradesh

Answer: d

3. What is the primary geological feature of the Chota-Nagpur Plateau?

A. Desert

B. Volcano

C. Plateau

D. Delta

Answer: c

4. Which river flows through the Chota-Nagpur Plateau and has carved out the famous Marble Rocks at Bhedaghat?

A. Ganges

B. Yamuna

C. Narmada

D. Godavari

Answer: c

5. What type of minerals is predominantly found in the Chota-Nagpur Plateau?

A. Precious gemstones

B. Iron ore and coal

C. Gold and silver

D. Salt and limestone

Answer: b

6. Which tribal group is one of the largest indigenous communities in the Chota-Nagpur Plateau region?

A. Punjabis

B. Santhals

C. Marathas

D. Bengalis

Answer: b

7. What is the traditional occupation of many tribal communities in the Chota-Nagpur Plateau region?

A. Fishing

B. Agriculture

C. Mining

D. Trade

Answer: b

8. Which city is known as the "Steel City of India" is located in the Chota-Nagpur Plateau region?

A. Kolkata

B. Ranchi

C. Jamshedpur

D. Bhubaneswar

Answer: c

9. Which famous national park in the Chota-Nagpur Plateau is known for its tiger population and biodiversity?

A. Jim Corbett National Park

B. Bandipur National Park

C. Kanha National Park

D. Palamau Tiger Reserve

Answer: d

10. What type of climate is generally found in the Chota-Nagpur Plateau region?

A. Tropical rainforest

B. Desert

C. Temperate

D. Monsoon

Answer: d

Q.11 The Chota-Nagpur Plateau is primarily composed of

a) Granite, limestone and Dolomite b) Sandstone, Limestone and Shale

c) Achaean rocks of Granite and Gneiss etc d) Gondwana Coal, Sandstone and Limestone

Ans. **c)** Achaean rocks of Granite and Gneiss etc

Q.12 Highest Peak of Chota-Nagpur Plateau

a) Barsot b) Jarimo

c) Sendraili d) Parasnath Mountain Peak

Ans. **d)** Parasnath Mountain Peaks (1370 mts)

Q.13 According to Census 2021 population of Chota-Nagpur Plateau

a) 32988134 b) 26945829

c) 13060792 d) 13885037

Ans. **b)** 26945829

Q.14 Hundru water fall is in

a) Chota-Nagpur Plateau b) Calcutta

c) Deccan Plateau d) Chattisgarh

Ans. a) Chota-Nagpur Plateau

Q. 15 Uranium is found in which part of Chota-Nagpur Plateau

a) Singhbhum b) Pat Region

c) Jadugora d) Damodar Valley

Ans. c) Jadugora

Q. 16 The western part of the plateau consist of highest part is known as

a) Koderma Plateau b) Damodar Trough

c) Manbhum and Sighbhum d) Pats

Ans. d) Pats

Q.17 Which valley is known as the prime centre of coking coal in the country

a) Indus Valley b) Damodar Valley

c) Doon Valley d) Zaskar valley

Ans. b) Damodar Valley

Q.18 Heart of Industrial India Known a “Ruhr of India”

a) Damodar Valley b) Neora Valley

c) Dibang Valley d) Solang Valley

Ans. a) Damodar Valley

UNIT 16 THAR DESERT, ARAVALIS UPLAND AND MALABAR COASTAL REGION

16.1 OBJECTIVES

After having the detailed study of this unit you will be able to:

1. Evaluate in detail the Thar Desert of India.
2. Understand in detail the Aravalli Uplands.
3. Understand examine in detail the Malabar Coast.
4. To discuss the problem and prospects and Significance of these regions.

16.2 INTRODUCTION

Present unit deals with physiographic and morphological study of Thar Desert, Aravalli Upland and Malabar Coastal region. Unit starts with the formulation of few objectives as mentioned above. According to these objectives the study has been conducted. Physiography of Thar Desert is conducted and then its physical condition and socio-economic study is done. For the physiographical and morphological study of Aravalli Upland firstly the following divisions are studied on the basis of present relief features: 1) Western Sandy Plains, 2) Aravalli Range and Hilly Regions, 3) Eastern Plains, 4) South-eastern Rajasthan Patthar. After this physical feature like climate, rainfall, vegetation, flora, fauna of Aravalli upland have been considered for the study Socio-economic condition are taken one by one in brief. Similarly physiographic study and morphological study of Malabar Coast is conducted in detail and the socio-economic situation is taken in brief. In the last Problem, Prospects and significance of Thar Desert, Aravalli Uplands and Malabar Coastal region of India are discussed. A short Summary of Thar Desert, Aravalli Upland and Malabar coast is cited at the end. After the short Summary, Glossary and References are also cited and finally unit ends with some terminal questions.

16.3 THAR DESERT, ARAVALIS UPLAND AND MALABAR COASTAL REGION

16.3.1DETAILED STUDY OF THAR DESERT

Thar Desert is one of the major six physiographic regions of India. Desert is an arid and semi-arid regions and are also known as “Marusthal”. It is a low latitude desert and is also

known as tropical desert. The name Thar is derived from "thul' a term used for the region's sand ridges. The Thar Desert is a arid region that covers an area of 200,000 sq kms. It is the 20th largestdesert, and the world's 9th largest hot sub-tropical area. It extends from 27^0 28' N to 27^0 46' N Latitude and 70^0 37' E to 70^0 62' E Longitude. It is bordered by plains of Indus River to the west, Punjab plain to the north and north-east, Aravalli Range to the south east and Rann of Kutchh to the south. More than 60% of the desert lies in the Rajasthan.

Fig 16.1: Dhar dessert.

Source: Google Map

During the last glacial period about 20,000 years ago, whole of the Tibetan Plateau was covered with ice. Due towhich four times more radiation was reflected back to the atmosphere and this also lead to cooling of the upper troposphere. Because of this there was no thermal low pressure over Tibetan Plateau and thus there was no monsoon over Indian subcontinent. This led to the formation of desert over north western part of India. Further the land surface of the Thar Desert is wind deposited (Aeolian) accumulation of sand over the past 1.8 million years. During the Mesozoic era, the landmass of the Thar Desert was under the sea. Marine deposits around Brahmsar near to Jaisalmer show the presence of the marine submergence of the land. The Thar Desert can be divided into two parts on the basis of slope: a) The slope of the northern part of Indian Desert, b) The slope of the southern part of the Indian desert, is towards the Rann of Katchh. Its surface has high and low sand dunes seprated by sandy plains and low barren hills

(bhakars). The dunes are in continual motion and keep varying in their shapes and sizes. Some of the older sand dunes are of 150 mts height. The region has playas (saline lake beds), locally known as dhands, scattered throughout the region. Examples the Sambhar, Kuchaman, Didwana, Pachpadra, Phalodi (Rajasthan), Kharagoda (Gujrat), Lunkaransar are major sources of the common salt.

Fig: 16.2: Landforms in Thar desert.

Source: Google Map

Large part of Thar Desertis enclosed by sand plains consisting of sand dunes. There are two types of sand dunes: a) Barchans Dunes: It is crescent/half-crescent in shape and are found in very large areas. b) Longitudinal dunes are mostly found on the border of India and Pakistan. Chhatra or mushroom rocks and sand dunes are important geomorphological features of Thar Desert. “Dhriyan” are the shifting sand dunes. Oasis is also found in the southern part of the Thar Desert(Singh, 2022).

Climate:

The climate of Thar Desert is arid and Sub-Tropical. Average temperature varies with season. The winds are dry north east monsoon and the desert record temperatures up to 50^0 C in the months of May and June. The coldest month is January with the minimum temperature of 5-

10^0 C. The winters are short for two months only i.e.in December and January. Dust storms blow with velocities of up to 150 kms /hr during the peaks summer season.

Rainfall

The Thar Desert receives low annual rainfall, of about 4 inches (in the west) to 20 inches (in the east). Average annual rainfall ranges from 100 to 500 mm, and occurs during the short period of July-September southwest monsoon. The desert has both, a very dry part Marusthali in the west and a semi-desert part in the east. East part has less sand dunes and slightly more precipitation.

Soils

The soil of Thar Desert consist of a few main groups- a) Desert Soil, 2) Red Desertic Soil, 3) Sierozems (brownish gray soil), 3) Red Yellow soils of the foothills. 4) Saline soils of the depressions, 5) Lithosols shallow weathered soils, and 6) Regosols soft loose soils found in the hills. These all soils are coarse-textured, well drained and calcareous (calcium-bearing). The soils are generally infertile. The soil of Thar Desert remaindry for much of the year, hence it is prone to wind erosion**.**

Rivers

The main river of Thar Desert is Luni, originates from the Pushkar valley of the Aravalli range and reaches the Arabian Sea through the Rann of Kutchh. It is first known as Sagarmati, after passing Govindgarh, it meets its tributary Sarasvati, which originates from Pushkar Lake and from then on words it is called Luni. It is a salt water river. The Jawai, Suki, Guhiya and Bandi are its left tributaries and Jojari is the right tributaries. Beyond this, Indira Gandhi Canal is the source of fresh water and irrigates the vast expanse of the Indian portion of the Thar Desert. The major irrigation system is the Rajasthan Canal System (Khullar, 2003).

Agriculture:

Kharif crops are the main Agricultural production, grown in the summer season and seeded in June and July, harvested in September and October. The main crops are Bajra, pulses, guar, Jowar, Maize, Sesame and Groundnuts. The Thar Desret is also a major producer of opium and the consumer also.

Vegetation

The vegetation of Thar Desert is mostly herbaceous or stunted scrub, drought-resistant trees occasionally dot the landscape, especially in the east. On the hills, Gum Arabica, Acacia and euphorbia, jojoba are found. The Khajri or Khejri trees grown throughout the plains to stop the further growth of desert. Thinly populated grasslands are also found in patches.

Flora

Thar Desert is comprises of trees, shrub and herb species. Trees are like Ziziphus, Acaia, Jojoba, Mimosa, papal, babul etc, Herb Grasses like: Biflorus, Saccharum, Panicum etc. Endemic flora species are: Acaia, Calligonum, Prosopis etc.

Fauna

The Thar Desert have 141 species of migratory and resident birds like Falcon, Buzzards, Vultures, Short-toed Eagls, greater Spotted eagle, Indian Peafowl, Peacock, Kestrel etc. Animals like blackbuck, Chinkara, Indian wild ass, foxes, partridges, snakes and camel. Thar cow and reptiles are common animals in the desert area. Endangered species of bustard is also found in the desert.

Transport andIndustries

Roads and railways are few in Thar Desert. The Indian part of the desert is in southern region of Thar Desert and second is Merta Road to Suratgarh via Bikaner and connects Jodhpur and Jaisalmer. Thermal power generating power plant depend on coaland oil supply power to local towns of Thar Desert while Hydroelectric power is supplied by the Nagal PowerPlant which is located on SutlejRiver. The government initiated departmental exploration of oil in 1955 and 1956 in the Jaisalmer area. Oil India Limited discovered natural gas in Jaislamer in the year 1988.

Social and Cultural Life

The Thar Desert is the most widely populated desert in the world, with a population density of 83 people per sq kms.Total Population is 16,600,000 and Populationgrowth is 20.23%. Sex ratio is 900 per 1000 of male. Region registered 5.13% of rural population and 24.87% urban population. Total literacy rate of Thar Desert is 0.56% and male registered 82.03% literacy

rate while female registered 53.00% literacy rate.Inhabitants comprise of Hindus (88.49%), Muslims (9.0%), Sikhs (1.27%), Jains (0.91%), Christians (0.1%) and Buddhist (0.02%) (Census, 2011 India). The ethnic composition of Thar Desert is diverse. Among the most prominent group are Rajputs, found in central region. Many nomads are engaged in animal rearing, crafts, or trade. The major languages are Sindhi spoken in southwest, Lahnda in the northwest, and Rajasthani preferred by Marwari in central and eastern region in Thar Desert. Jodhpur is the nearest largest city while Bikaner and Jaisalmer are the largest cities located entirely in the desert.

Economy

The main occupation of inhabitants isagriculture and animal husbandry. Grass production is used for several medicinal use, this provide good revenue by the small framers. Further, the cattle's rearing is doneby the farmers and also by dairy workers. Camels are used for ferrying people from one place to another. Ecotourism is also one of the major sources of revenue earning. Wool production is also another important source of economy. Cotton and wheat arepreferred by the people of Thar Desert for economy.Water of Indira Gandhi Canal is used for irrigation in the Thar Desert. Government of India has started the Oil production formtheland of Thar Desert.

Problems and Prospects

1. Thar Desert inhabitant depends on subsistence agriculture but, because of increasing developmentalopportunitiesand population pressure, there are increasing of several environmental threats.

2.Temperature exceeds 50^0 C in the summer months. It becomes very difficult for the people to work in mines and open fields and even for the tourism activities in hot summers. This makes the development difficult.

3.Rainfall is very less and water supply is very limited, it becomes very hard to carry outagricultural practices. This causes thedevelopment of the region very limited.

4. Most of the desertportion is inaccessible due to extreme adverse environmental conditions and poor infrastructure. The inaccessibility of many parts of the desert led to greater difference between the rich and the poor.

5. Thar Desert has valuable reserves of minerals such as feldspar; gypsum and kaolin. There is needed to be developingthis aspect very carefully.

6. Thar Desert is also the main source of solarand wind energy. If developed efficiently then both the sun and wind energy could easily fulfill the need of the pure and pollution free source of energy.

7. Tourism is also another source of economy. Tourist likes to visit and explore Thar Desert.This source of economy is also needed to be developed further more.

16.3.2 DETAILED STUDY OF ARAVALLI UPLANDS

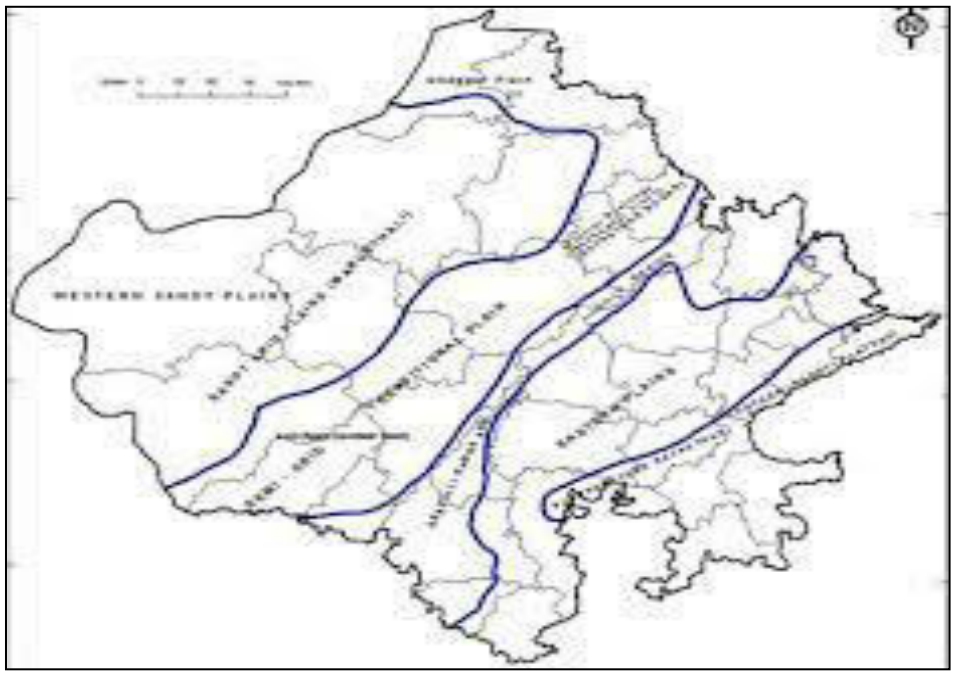
Rajasthan is the largest state of India and has more physical variations than any other state. It has rolling sand dune in the west and lofty rocks in the middle of fertile plains in the east. On the basis of present relief features,Rajasthan can be divided into following sub division:

1. Western Sandy Plains
2. Aravalli Range and Hilly Regions
3. Eastern Plains
4. South-eastern Rajasthan Plateau

1. Aravalli Ranges

The Aravalli Range is a mountains range in Northern –Western India, ‘approximately 670 kms in a south-west direction, starting near Delhi, passing through Haryana, Rajasthan, and ending Ahmadad Gujarat. It extends 240^{0}00’ N to 725 ^{0} 35’ N Latitude and 73 ^{0}30’ E to 74 ^{0} 42’ E Longitude. The Aravalli ranges are the oldest mountain as geological feature on the Earth. It is rich in natural resources and serves as a check to the growth of the western desert.

Fig16.3:Detailed study of Aravalli Uplands.



Source: Google Map

Aravalli Range dates back to times when the Indian plate was separated from the Eurasian Plate by the ocean. Originated in the Proterozoic era. Thar rose in Precambrian event called the Aravalii-Delhi Orogen. In ancienttime Aravalli were extremely high but since have worn down almost completely from millions of years of weathering.

Aravalli range has been further sub-divided into two smaller units:

1. North-Eastern Aravalli Range
2. Central Aravalli Range
3. The Mewar Rocky Region and Bhorat Plateau
4. Abu Block Region

1. The North-Eastern Hill Tracts or Alwar Hills

It includes the city Jaipur, Sikar, Alwar stretches from Delhi to Alwar & Jaipur. They are also known as Alwar Hills. Form northeast it merges with Ganga-Yamuna plains. Their height is 300 mts to 670 mts having flattered hill tops with wide valleys. Important hills are Malkhet

&Khetri Group of Hills and Torwati hills, important peaks are Raghunathgarh (1055 m), Barwara in Jaipur (786 mts), Sariska in Alwar (677 mts). It Consist of lakes Sambhar, Ramgarh etc.

2. The Central Aravalli Range

The Central Aravalli includes the city like Ajmer, Jaipur etc. Their length is 100 kms with width 0f 30 kms. and valley depth of 550mts. Height is about 77 mts. It extends from Sambhar Lake to Bhorat Plateau. Surrounded from Alwar hills in the north, Banas Plain in the south and Sambhar Hills in the west. Major hills are Skekhawat lower hills and Marwar hills having the highest peaks namedGoramji in Ajmer (934 mts), Nag Pahar in Ajmer (795 mts).

B1. The Sambhar Basin of Shekhawat Low Hills: includes district like Churu, Sikar, Jhunjhunu etc. Their average height is 44 mts, this region is full of sand hills & with inlands drainage.

B2. The Marwar Hills: Consisit of Jodhpur, Barmer, Jaisalmer, Nagur etc. and covers an aera of 4400 sq.kms. and average height 550 mts. These hills are in vicinity of Ajmer city (Hussain, 2008 a)

3. The Mewar Rocky Region and Bhorat Plateau

It comprises of districts like Udaipur and Dunagrhpur. They have an area of 17007 sq. Kms. and average height 1225 mts. Altitude of Bhorat. Bhorat plateau is one of the highest table lands of Aravalli. They includethe hills like Mewar hills, Bhorat Hills,Girwa hills, Marwar hills etc. and the major peaks like Dhoniya (1183 mts), Rrishikesh (1017 mts), Lilagarh (874 mts).

4. Abu Block Region

Abu blocks have been separated from the main Aravalli range by a wide valley of the West Banas. Extend from west to Abu inSirohi Sea Level. Itfall in district like Abu, Sirohi and have an area of 5180 sq kms. with length 10 kms and width 8 kms. These ranges have hills like Abu Hills and Oria Plateau. Highest peaks are Guru Shikhar in Sirohi (1722 mts), Dilwara in Sirohi (1442 mts) etc.

Climate

The northern Delhi Aravalli range and Haryana has humid subtropical climate and hot semi-arid continental climate with very hot summers and relatively cool winters. The main

characteristic of their climate is dryness, extremes temperature, and scanty rainfall. The maximum day timetemperature during the summer varies between 40^0-46^0 C. During winter, range of temperature is $1^0 4^0$ C. The Central Aravalli range has arid and dry climate. The southern Aravalli range has tropical wet and dry climate.

River

There are three main river of Aravalli ranges namely Banas and SahibiRivers which are tributaries of Yamuna, andLuniRiver which flows into Rann of Kutchh. North to south flowing rivers areLuni, Sakhi and Sambhar Rivers. West to north-west flowing river areSahibi River, Hajafgarh drain, Dohna River, Sota River, Krishnavati River and West to north-east flowing rivers are Chambal River, Banas River, Berach River, Ahar River, Wagli River,Wagon River, Gambhir River and Orai River.

Rainfall

The mean annual rainfall is 937 mm with a coefficient of variation of 22.2 per cent which indicate that annual rainfall is more or less stable over the year. The Aravalli ranges are parallel to the moisture laden monsoon winds. Eastern part receives more rainfall while western part receives less rainfall. In the south Aravalli. It has a slight east-west direction andreceives good rainfall. The southern Aravalli are much green than the north. Moisture of monsoon winds from Bay of Bengal is stopped by Aravalli and making the western part of Rajasthan a desert(Ahir, 2007).

Soil

Red soil is found in Aravalli ranges. This red soil if formed by crystalline igneous rocks in areas of low rainfall in the eastern and southern part of the Deccan Plateau.

Agriculture

Various farmers' daily bread is associated with alluvial soil which is found in Aravalli range. Some crops are rice, cotton, etc.

Vegetation

Aravalli trees species are like Dhau, Salai, Amaltash, Dhak, Kullu, Ronjh, Doodhi, Harsingar, Krishna Kadam etc. Under story trees are like Bistendu, Kuda, Chamrodetc, are lesser

in height than that of main canopy trees and considered as 2nd tire. Shrubs like Goyakhair, Gangeti, Adusaetc are still less in height than the second canopy trees and come under 3rd tire.

Fauna

The ecological diverse niche is found. The most common type of mammals found are: Jackal, Blue bull, Mangoose, Indian hare, Bats, etc.Aravallis are home for more than 190 species of birds like Bee-eater, Cukoos, Bulbuls, Drongos, Warblers, Parakeets, Patridges, Woodpeckers etc. Amphibians and reptiles are also found. About 29 species of of amphibians are found like toad, turtle, Indian cobra, Indian Krait, Saw scaled viper, Royal Rat snake, Red sand Boa etc. Among lizard, Indian monitor lizard, Fan throated lizards, striped grass lizard are common (Ojha, 2007a).

Social and Cultural Life

Population of Aravalli uplands is 1039918 with density of population is 310sq.kms. Urban population is 12.17 % and rest 87.83% population is rural population. Sex ratio is 953 females per 1000 of males. Hindus registeredare 93.79 per cent and Muslims are 5.63 per cent. Languages are mainly Rajasthani used by more than 9 per cent of population and Hindi by 1.31 per cent of population. SC population is 5.98 % and ST population is 20.57 % (Census, 2011 India b). Main tribes are Marwadi, Meena, Gujaras and Gadadiye. Aravallisrecord three main cultural stages: Early stone age, mid- Stone Age and post stone age. Further Aravallis have registered two culture civilization: 1) Tosham Hills Indus Civilization and 2) Ganeshwar Sonari Cultural Civilization.

Economy

The Aravalli ranges are the source of many rivers, which results in the development of Human settlements with sustainable economy since pre-historic time period. Mumbai-Ahmedabad High Speed Rail Corridor, North Western Railways network, Delhi-Jaipur Express, all run parallel to the length of the Aravalli Range providing an economic enhancement. Along with this Aravalli range is the home of forest, wildlife, protected area, forts, historical monuments and provide large impetus fortourism industries.

Problem and Prospects

1. According to the report of Wild life Institute of India, Aravalli is the home of most degraded forest and need conservation.

2. Left-out mines, artificial pits- lakes, loss of biodiversity, depleting ground water, incidence of diseases leading the Aravalli in the irreversible destruction and loss.

3. Conversion of forest land into non-forest activity lead to the deletion of environment, so hence is need of better policy development related with forest use.

4. Desertification in the east of Aravallis due to number of anthropogenic activitiesand projects create a worrying picture.

5. Encroachment of forest land combined with depleting wildlife habitat, dried-up points of water bodies have forced the wildlife to move in the human habitation.

6. For the rescue of wildlife and to save the biodiversity, number of national parks, wildlife Sanctuaries are developed like, Ranthambore National Parks, Sita Mata Wildlife Sanctuary, Mount Abu Wildlife Sanctuary, National Chambal Sanctuary etc.

7. The Aravalli Green Wall Project was launched recently. It is a initiative to green a 5 kms buffer area near the Aravalli Hill ranges in four states. The goal is to revive the Aravalli by the steps like water conservation, natural resource protection, Tiger reserves, Single- use plastic ban etc.

Significance of Aravalli Uplands

1. Accountable for adequate monsoon rainfall and therefore sustain the flora and fauna , rich biodiversity, and livelihood and agriculture the constituents area.

2. Aravalli ranges acts as a barrier to check further spread of desertification to the east of Rajasthan

3. Major rivers areLuni and Sabarmati, originates from the Aravalli rang. Seasonal streams along with their tributaries control the water budget in the arid regions of Rajasthan

4. Aravalli also acts as a barrier for the clouds to shift further east, thus contribute to the climate of north India.

5. Protect the land from the effect of westerlies flowing from the Central Asia Regions.

6. Aravalli acts as ground Water recharge for the region having acute water scarcity.

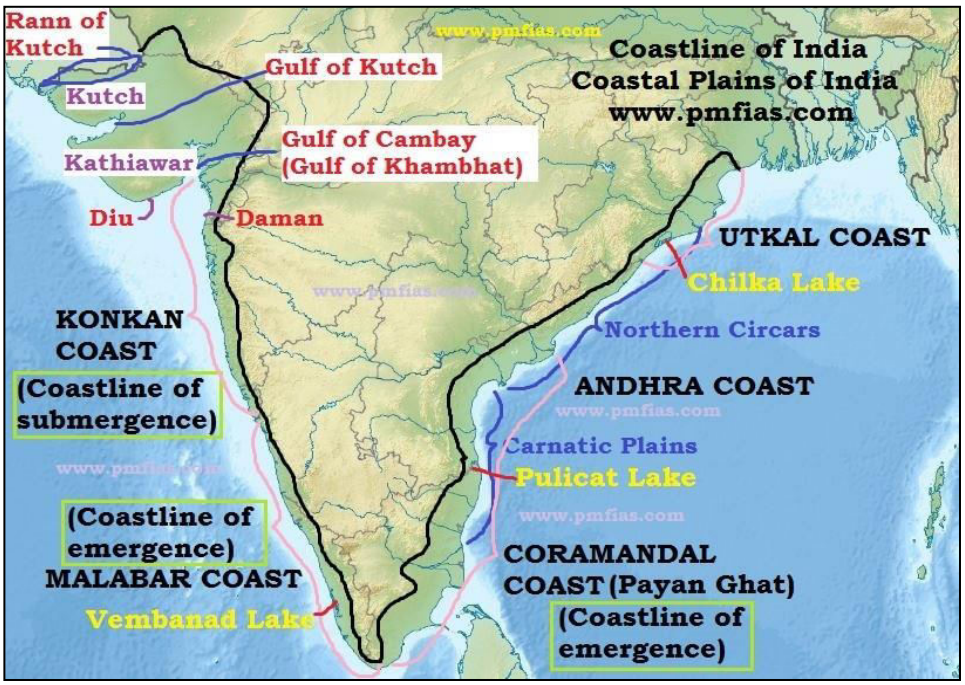
16.3.3 DETAILED STUDY OF MALABAR COASTAL REGION

The Malabar Coast refers to the southwest coast of India from Konkan to Kniyakumari. It is a narrow coastal plain of Karnataka and Kerala between Western Gats range and the Arabian Sea. The coast run from South of Goa to Kaniyakumari on India's southern tip. Malabar Coast comprises of coastal part of Goa, Karnataka, Kerala and Tamil Nadu**.** The Malabar Coast is the southwestern coast of the southwest coast, generally referring to the coastline of Western coast of India from Konkan to Kaniyakumari. Geographically, they are characterized by sandy beaches, coastal sand-dunes, mud- flats, lagoons, alluvial tract along river, estuary, laterite-platform etc. It comprises the wettest regions of south India including coastal part of Goa, Karnataka, Kerala and Tamil Nadu or we can say that Malabar Coast is an all-encompassing term for the entire Indian coast from the Konkan to the tip of the subcontinent at Kaniyakumari. The coast is 845 kms long and stretches fromsouth westernMaharashtra, along the region of Goa, through the entire western coast of Karnataka and Kerala and up to Kaniyakumari.Its extend is 10^0 15' N to 12^0 18'N Latitude and 75^0 14'E to $76^0$56'E Longitude. Kuttanad is the point of least elevation in the India, lies in the Malabar Coast. Kuttanad is also known as The Rice Bowl of Kerala and it is one of the few places where cultivation takes place below the sea level. Whereas Anamundi, the highest peak in India outside the Himalayan range lies parallel to the Malabar Coast. The Malabar Coast can be divided into three climatic regions: 1) Eastern highlands: rigged and cool monotonous terrain, 2) The Central mid-lands: includes the rolling hills, and 3) the Western lowlands includes coastal plains (Hussain, 2008 b).

In the british time, Malabar was used to have foreign trade. and it was known as Kerala at that time. Arab sailor used to call it Kerala Male. Al-biruni mention Malabar ports in their work. And call it Malibar, Manibar. According to William Logan, the word Malabar is the combination of Mala and Barr.

Malabar western coastal belts are relatively flat compared to the eastern region. It is interconnected by brackish canal, lakes, estuaries and rivers known as Kerala (Kayal) Backwater. **Vemband** is the largest lake in India is the part of Kerala backwaters.

Fig. 16. 4 Malabar Coastal regions.



Source: Google Map

The**Athirapilly Falls** is located on Chalakudy River. **Periyar**is the longest river of Kerala.**Sandy beaches** with coconut palms are found everywherealong the Malabar Coast.

Due to its orientation to the sea and maritime climate, it becomes the home to some of the first groups to Jews; known as cochin Jews,Syrian Christian; known as Saint Thomas Christians, Muslims; known as Mappilas and Anglo-Indians in India.

Port Cities

Port cities in the ancient period were Naura, Vizhinjam, Muziris, Nelcynda, Thundi etc. Kozhikode, Kollam, Kannur, Cochin in the medievalperiod remain as center of ocean trade for millennia and have served as centers of the Indian Ocean trade for millennia.

Climate

MalabarCoast is tropical and humid. Especially due to its westward-facing mountain slopes, comprises the wettest region of south India, as the Western Ghats intercept the moisture-laden southwest monsoonal winds. Rainfall varies seasonally, falling mostly with the southwest

monsoon between June to September. Rainfall is higher in south. Decreases and become seasonal towards the north.

Rivers

The rivers that flow through this region are Narmada, Tapi, Zuari and Mandovi. The western coast is further divided into Konkan coast and Malabar Coast. The rivers of the Malabar Coast are Sharavasti River and GangavatiRiver.

Agriculture

Half of the population of Malabar Coast is engaged in a activities. The fertile alluvial soil is useful of growing many crops in this region. Major agricultural products are Black pepper, dove, cardamom etc are grown in this region. In plains coconut betel and cashew nutetc are grown. In the region of semi-mountainous area, Western Ghats, tea, coffee and rubber plantation is done. It is a narrow coastal plain bounded by the Western Ghats thus monsoon rains make the coast a fertile rice-growing region. It is a narrow coastal plain bounded by the Western Ghats. Monsoon rains make the coast a fertile rice-growing region. Rice and spices are the main crops with coconut palms on the coastal sand dunes. Fishing is also important among the different agricultural practices. The Malabar Coast has been a major spice exporter, according to Sumerian records and it is still referred to as the "Spice Garden of India" or as the "Garden of Species".

Vegetation

The Malabar coast have tropical and subtropical broadleaf forests of southwest. Major divisions are: 1) Southern hill Top Tropical Evergreen. 2) West Coastal Tropical Evergreen and 3) Wet Evergreen and semi-evergreen climax forest.

The Malabar rainforest are further divided into three divisions:

1. The Malabar Coast Moist Forests

2. South Western Ghats moist Deciduous Forests

3. South Western Ghats Montane Rain Forests.

1. **The Malabar Coast Moist Forest**:

It is found above 1000 mts elevation.Famous for coffee beans. The tropical mosit broadleaf forest is found in SouthwestIndia. It lies along India's Konkan and Malabar coasts, in a narrow strip between the Arabian Sea and the Western Ghats range, which run parallel to the coast. It has an area of 35,500 sq. kms. extends from northern Maharashtra through Goa, Karnataka and Kerala to Kaniyakumari.

2. **South Western Ghats Moist Deciduous Forest**:

The South WesternGhats Moist Deciduous Forest is a Tropical Moist Broadleaf Forest of southern India. It covers the southern portion of the Western Ghtas range of Nilgiri Hills between 250 and 1000 mts elevation in Kerala, Karnataka and Tamil Nadu states.

3. South Western Ghats Montane Rain Forest:

Found in southern region covering the southern portion of the Western Ghats range in Karnataka, Kerala and Tamil Nadu ata elevation over 1000 mts, They are cooler and wetter than the lower-elevation South Western GhatsMoist Deciduous Forests.

Flora

The Malabar Coast is most species rich region. The cool and moist climate, high rainfall and variety of microclimates because of difference of elevation. This support the lush and diverse forest. About 355 are endemic species. The tree generally from canopy at 15 to 20 mts and the forest are multistoried and rich in epiphytes, orchids. Other plants are of Gondwana, origins. Other evergreen trees species of the montane forest include Garcinia, Memecylon etc. Other major habitat is the Shola-grassland found at elevation of 1900 to 20220 mts. Upper story is small tress and low understory and a dense shrub layer characterized by frost and fire resistant grass species like Zeylanicus etc. Teak, coconutand acacia are also plant species of Malabar Coast.

Fauna

The Malabar Coast supports a rich fauna. Out of 309 birds species 13 are endemic. The elephant, tiger, leopard, sloth bear, gaur and wild dog are few examples. The lion-tailed macaque and NilgiriMacaqque are endangered species. About 206 amphibian's species are

endemic to this region. The region have include four species of hornbill, the Malabar grey hornbill, Indian grey hornbill, Malabar pied hornbill and great hornbill (Ojha, 200b)

Social and Cultural life

According to census 2011, population of Malabar Coastis 19176 of which 8813 are males and 10363 are females. Density of population is 816 /sq kms. and Growth rate is 3.31%. Urban population is 47.7 % and rural population is 52.3% of the total population. Sex ratio is 1084 per 1000 of males. Population distributions according to religion is Hindu 56.74%, Muslim 42.83%, Christians 0.17%, Sikh 0.01% and Buddhist 0.05%. Literacy rate is 96.21 % out of which male literacy rate is 97.65 % and Female literacy rate is 95.00%. Insignificant number of SC and ST population is found i.e. 1.40% and 0.32% respectively. The tribal population includes Cholanaikkans, Kurumbas, Kattunaikans, Kadars and Koragans are the five primitive tribes found in Malabar Coast.

Economy

Malabar Coastal Plain have extensive coastline, enriched with minerals and other resources, and has a rich biodiversity which significantly contributes to its growth and economic development. It has number of sea ports like Mormagao port in Goa, New Mangalore port in Karnataka. Coastal plains also provide economic activitieslike fishing, mining, salt farming, shipbuilding, metallurgy, manufacturing etc. The Exclusive Economic Zone (EEZ) provide access to marine resources and boost international trades which facilitate the foreign trade,In agriculture, major economy development is from spice garden. As Malabar Coast is the major Producer of spices in the country.

Problem and Prospects

1. Malabar Coast receives heavy rainfall from the Arabian sea branch of the southwest monsoon,some time causes flooding and water logging.
2. Coastal erosion of various magnitudes.
3. The original tropical evergreen forests have now largely been replaced by a semi-deciduous vegetation, mostly because of the influence of plantation trees such as teak, or forest degradation.

4. Destruction of mangroves forest due to increase in population and conversion of this forest intoagricultural land causes the environmental problem along with biodiversity depletion.
5. Sand mining is increasing day by day due to construction of building, bridges etc.
6. More concentration is given to the degrading environmental conditions and protected areas are made for improving the deleting environment and biodiversity, like Periyar National Park, Silent valley National Park. Idduki National Park etc.

Significance of Malabar Coastal region

1. The Malabar Coast was a centre of foreign trade in first century. Various goods were exchanges between Indian Industrialists/traders and foreign visitors and traders.
2. Coastal Plains of India are covered by fertile soils on which different crops are grown. Rice is the main crop of these areas. Coconut trees grow all along the coast.
3. The Malabar Coast has been a major spice exporter since the historic times. According to Sumerians records and it is still referred to as the "Garden of Spices". "Spice Garden of India".
4. Long coastlines have helped in its interaction through the sea. The sea routes passing through the oceans provide easy connectivity to India with the West and the East.

16.4 SUMMARY

The **Thar Desert**is the ninth largest subtropical desert in the world. Its surface has high and low sand dunes separated by sandy plains and low barren hills (Bhakars). They have morphological features like mushroom rocks, oasis, Playas (saline lake beds) etc. They receive low rainfall of 4 inches to 20 inches. The flora includes stunted scrub, drought resistant trees, acacia, babooletc. animals like falcon, camel, cow etc and birds like vulture, and retiles like lizards are common. The only river found in Thar Desert is Luni, Bajra is the main crop. It has Indira Gandhi Canal as the main irrigation system. Region has developed number of protected area to save the depleting environment and biodiversity. **The Aravallis**is a range that runs from north-east to south-west for about 800 kmsbetween Delhi to Palanpur (Gujrat).It is one of the oldest folded mountains. Its highest peak is Guru Sikhar (1722 mts). Aravallis are mainly made up of quartizites, geneisses and schists of Precambrina period. North-west of Udaipur, the

Aravallis are called Jarga Hills (1431 mts). The Goranghat Pass separated Guru Shikhar from Mount Abu. The Great Boundary Fault separates the Aravallis from the Vindhyan Mountains. **Malabar Coast**: Malabar Coast is about 550 kms long and 20-100 kms wide.This coast is characterized by sand dunes and Ashtamudi are the lagoons of the MalabarCoast. It is homeland to aquatic life like crabs, frogs, birds like kingfisher and cormorants and other otter live along the side of backwater. The backwater are important tourist spots, and important for transportation, fishing and even agriculture. The region has Monazite sands which is reddish brown and rich in phosphate. Monazite is radioactive due to presence of thorium.

16.5 GLOSSARY

Aeolian: Wind deposits

Bhakars: Low and high sand dunes are separated by sandy plains and low barren hills

Dhands: Saline water lake.

Dhriyan: Shifting sand dunes.

Marusthal: Life less area on earth surface.

Niche: A habitat having all the factors needed for the sustenance of species.

Oasis: An oasis is a unique water landform. In order to be considered an oasis, the area has to be surrounded by desert, have a water source and have vegetation.

Kayal: Backwater.

Kottanadi: is the point of least elevation in the India.

Thul: Region's send ridges

16.6 ANSWER TO CHECK YOUR PROGRESS

1. Do you that the largest state of India is Rajasthan?
2. The Guru Shikhar is the highest point in the Aravalli range.
3. Do you know that in the context of Indian physiography, the Great Boundary Fault separates the Aravallis from the Vindhya ranges?
4. Do you know that Periyaris the longest river of Kerala?

5. The main river of Thar Desert is Luni, originates from the Pushkar valley of the Aravalli range and reaches the Arabian Sea through the Rann of Kutchh.

16.7 REFERENCES

1). Ahir, R. (2007). Geography, Spectrum Books Publication Pvt. Ltd. (New Delhi), pp. 455-459.

2) Census of India, 2021 a. Census of India, StatitsticalAbstarct of Rajasthan, Retrived on 16, May,2023.

3) Census of India, 2021 b. Census of India, StatitsticalAbstarct of Rajasthan, Retrived on 16, May, 2023.

4) Census of India, 2021 c. Census of India, StatitsticalAbstarct of Goa, Kerala, Karnataka, Retrived on 16, May, 2023. Retrived on 18, May, 2023.

5). Google Map (a): The That Desrt, Retrieved on 15, May, 2023.
https://media.gettyimages.com/id/541044294/photo/camel-safari-in-thar-desert.jpg?s=612x612&w=0&k=20&c=ztMX0uaMuY4kN6anx8Ak8cx4zDYqcJ_PyxEWd5UPDzE=

6) Google Map (b): The That Images, Retrieved on 15, May, 2023.
https://media.gettyimages.com/id/1294280646/photo/great-indian-desert.jpg?s=612x612&w=0&k=20&c=gDsXgjBNPmuiOx-dknpsE3jcc5s9TzwYIrAGwwrJDOM=

7) Google Map (c): The Aravalli Images, Retrieved on 15, May, 2023.
R2M&w=1347&h=1244&q=Physiography%20of%20aravalli%20uplands%20of%20rajasthan%20wikipedia&ved=2ahUKEwjbs7uu8qT_AhXX1XMBHdwFCcEQMygKegQIARA4

8) Google Map (d): The Malabar Coast Retrieved on 15, May, 2023.
https://www.pmfias.com/wp-content/uploads/2016/01/Coastline-of-India-%E2%80%93-Indian-Coastline.jpg

9) Hussai, M. (2008a). Geography of India, McGraw Hill Education (India) Private Limited, pp. 2.35 to 2.36.

10) Hussai, M. (2008b). Geography of India, McGraw Hill Education (India) Private Limited, pp. 2.41 to 2.42. .

11) Khullar, D.R. (2003). *ISC Geography*, New Delhi, Kalyani Publishers, pp. 27-29.

12) Ojha, S.K. (2007a). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, pp. 59-63.

13) Ojha, S.K. (2007b). Bharat Ka Bhugol: Indian Geography, BhaudhikPrakashan, Allahbad, pp. 72-75.

14) Singh, S. (2022). Physical geography, Pravalika Publication Pryagraj, pp291-293.

16.8 TERMINAL QUESTIONS

(A) LONG QUESTIONS

Q.1 With a suitable diagram explains the physiographic division of Thar Desert.

Q.2 Briefly describe the Socio-economic conditions of Thar Desert.

Q.3 Examine in detail the Aravalli Upland of India. .

Q.4 Discuss the socio economic and significance of Aravalli Upland of India.

Q.5 Examine in detail Malabar Coastal region.

Q.6 Discuss in brief the socio-economic conditions and significance of Malabar Coastal region.

(B) SHORT QUESTIONS

1. Where is the Thar Desert located in India?

2. What is the dominant source of water in the Thar Desert region?

3. What are some of the unique vegetation adaptations in the Thar Desert?

4. What are some of the challenges faced by the people living in the Thar Desert, and how do they adapt to the harsh environment?

5. Where are the Aravalli Uplands located?

6. What is the significance of the Aravalli Uplands in terms of geology?

7. What are some of the ecological features of the Aravalli Uplands, and why are they important?

8. Where is the Malabar Coastal Region located in India?

9. What is the significance of the Malabar Coast in terms of trade and history?

10. What are some of the key geographical features of the Malabar Coast that influence its climate and ecology?

(C)MULTIPLE CHOICE QUESTIONS

1. Which state in India is home to the majority of the Thar Desert?

a) Gujaratb) Rajasthan

c) Haryanad) Madhya Pradesh

Answer: b

2. What is the predominant source of water for the Thar Desert region?

a) Monsoon rainsb) Rivers

c) Glacial meltwaterd) Underground aquifers

Answer: d

3. Which of the following is a characteristic plant of the Thar Desert known for its drought resistance?

a) Bamboob) Mango tree

c) Khejri treed) Banana plant

Answer: c

4. Which animal is commonly used for transportation in the Thar Desert due to its adaptability to arid conditions?

a) Elephantsb) Horses

c) Camelsd) Cows

Answer: c

5. What is the main economic activity of the people in the Thar Desert region?

a) Fishingb) Agriculture

c) Miningd) Tourism

Answer: b

6. Where are the Aravalli Uplands primarily located in India?

a) Northern Indiab) Southern India

c) Western Indiad) Eastern India

Answer: a

7. What is the geological significance of the Aravalli Uplands?

a) Youngest mountain range in India

b) Home to active volcanoes

c) One of the oldest mountain ranges in the world

d) Rich in coal and petroleum deposits

Answer: c

8. Which state in India has the Aravalli Uplands as a prominent geographical feature?

a) Keralab) Rajasthan

c) Karnatakad) Assam

Answer: b

9. What is the primary type of rock found in the Aravalli Uplands, making them significant for the mining industry?

a) Graniteb) Marble

c) Sandstoned) Limestone

Answer: b

10. Which important wildlife sanctuary in the Aravalli Uplands is known for its leopard population and biodiversity?

a) Ranthambhore National Park

b) Sundarbans National Park

c) Gir National Park

d) Sariska Tiger Reserve

Answer: d

11. The Malabar Coast is located in which Indian state?

a) Andhra Pradeshb) Kerala

c) Tamil Nadud) Karnataka

Answer: b

12. What is the historical significance of the Malabar Coast?

a) It served as a major trade route during the Indus Valley Civilization.

b) It was a center for the spice trade and attracted traders from around the world.

c) It was the site of several ancient Buddhist monasteries.

d) It was the first landing point of European colonizers in India.

Answer: b

13. What geographical feature influences the climate of the Malabar Coast, making it receive heavy rainfall during the monsoon season?

a) Western Ghatsb) Thar Desert

c) Deccan Plateaud) Eastern Ghats

Answer: a

14. The backwaters, lagoons, and coconut groves are characteristic features of which part of the Malabar Coast?

a) Northern Malabarb) Central Malabar

c) Southern Malabard) All along the Malabar Coast

Answer: c

15. Which famous dance form, often associated with the Malabar region, features rhythmic footwork and is traditionally performed by men?

a) Kathakalib) Mohiniyattam

c) Theyyamd) Kalaripayattu

Answer: d

Q.16 In which era, the Great Indian Desert was under the sea?

a) Pre Cambrian Era b) Paleozoic Era

c) Mesozoic Era d) Cenozoic Era

Ans. **c)** Mesozoic Era

Q.17 Shifting sand dunes of the Thar Desert is locally known as

a) Bagar b) Rohi

c) Dharian d) Doab

Ans. **a)**Bagar

Q.18 What is the approximate amount of rainfall in the Indian Desert every year?

a) 15 cms b) 15 mms

c) 25 mms d) 25 cms

Ans. **a)** 15 cms

Q. 19 What percentage of the area of the Thar desert lies in India?

a) 45% b) 55 %

c) 85 % d) 95 %

Ans. **c**) 85 %

Q. 20 Which is the highest Peak in Aravalli range?

a) Mt. Abu b) Guru Shikhar

c) Taragarh d) Kamalnath

Ans.**b**) Guru Shikhar

Q. 21 Which of the following river originate from the Aravalli ranges?

a) Betwa b) Kaveri

c) Ghagara d) Sabarmati

Ans. 6 **d**) Sabarmati

Q. 22 The Highest point in the Aravallis

a) Guru Shikhar b) Anamudi

c) Panch Marhi d) Dodabeta Peak

Ans. **a**) Guru Shikhar

Q. 23 Aravalli ranges is example of

a) Straight Mountain b) Block Mountain

c) Residual Mountain d) Volcanic Mountain

Ans. **c**) Residual Mountain

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