# PHYSIOGRAPHY, DRAINAGE BASINS AND MONSOON OF INDIA

After going through this chapter you will be able to understand the following features.

- 1.1 Objectives
- 1.2 Introduction
- 1.3 Subject- Discussion
- 1.4 Theories behind the Origin of Himalayas
- 1.5 Physiography of Himalaya
- 1.6 Theories behind the Origin of the Deccan Plateau the Peninsular India
- 1.7 Physiography of the Deccan Plateau or the Peninsular India
- 1.8 Theories behind the Origin of The Great Plains of India
- 1.9 Physiography of The Great Plains of India
- 1.10 Theories behind the Origin of The coastal Plains of India
- 1.11 Physiography of The coastal Plains of India
- 1.12 Different types of drainage patterns
- 1.13 Himalayan and Peninsular Drainage basins of India
- 1.14 Monsoon of India
- 1.15 Summary
- 1.16 Check your Progress/Exercise
- 1.17 Answers to the self learning questions.
- 1.18 Technical words and their meaning
- 1.19 Task
- 1.20 References for further study

# **1.1 OBJECTIVES**

By the end of this unit you will be able to -

- understand the origin and physiography of the mighty Himalayas
- know the origin and physiography of the Peninsular India
- understand the origin and physiography of the Great Plains of India

- know the origin and physiography of the Coastal Plains of India
- Understand the basic drainage patterns like Dendritic, Annular, Trellis, Rectangular and others.
- Know the Drainage basins of the Himalayan Rivers in India and the river basins of the Peninsular India.
- Understand the origin Monsoon of India and different seasons along with rainfall distribution.

# **1.2. INTRODUCTION**

In this chapter we will discuss on the followings:

- 1. The mighty Himalayas and their associated young folded mountains.
- 2. The elevated Peninsular region
- 3. The Indo-Gangetic-Brahmaputra Plains
- 4. The Coastal Plains and Islands
- 5. Different drainage patterns.
- 6. Monsoon of India



**Fig: India Political** 

# **1.3. SUBJECT DISCUSSION**

**The Himalayas** are considered as the body and soul of India because they have affected the life of Indian people since time immemorial.

**The Indo-Gangetic plain** is the largest unit of the Great Plain of India covering an area of about 3.75 lakh sq km in the states of Uttar Pradesh, Bihar and West Bengal. The Ganga along with its large number of tributaries, the Yamuna, the Gomati, the Ghaghara, the Gandak, the Kosi, etc. have brought large quantities of alluvium from the mountains and deposited it here to build this extensive plain. In social and economic terms, the Indo-Gangetic Plain is the most important region of India.

Major Geological Formations of the Peninsular India was about 3600 million years ago. It is a large plateau; making up most of the southern part of the country. The north-western part of the plateau is made up of lava flows or igneous rocks known as the Deccan Traps. The rocks are spread over the whole of Maharashtra and parts of Gujarat and Madhya Pradesh. It is separated from the Gangetic plain to the north by the Satpura and Vindhya Ranges.

To the east and west of the peninsular plateau, two narrow strips of plain lands are found, which are respectively **called Eastern Coastal Plain and Western Coastal Plain**. Eastern Coastal and Western Coastal Plain are formed by the erosional and depositional & activities of the Sea waves and from the sediments brought by the peninsular rivers.

In this chapter we will also learn about different drainage patterns. Before that we must understand what drainage is. The term 'drainage', refers to the river system of an area. Small streams from different directions join to form a river. The river ultimately empties itself into a larger water body i.e. a lake, a sea or an ocean. The area that a single river drains is the drainage basin of that river. Sometimes two drainage basins are separated by upland or a mountain/hill. Such upland or mountain is called water divide. World's largest drainage basin is of the River Nile in Egypt in Africa. River Ganga has its largest drainage basin in India.

We will also learn about the Himalayan as well as the Peninsular Rivers of India. **Himalayan** rivers are those which originate in the Himalayas and flow through the Northern Plains, e.g., **the Ganga, the Yamuna, the Indus and their tributaries**. These rivers are snow fed, perennial and useful for irrigation and navigation. The lowlands drained by them have fertile alluvial deposits. On the other hand, the **Peninsular** Rivers, except

Narmada and Tapti, originate in the Western Ghats , flow eastwards on the plateau and drains in to the Bay of Bengal. They have a large seasonal fluctuation in volume as they are solely rainfed. These rivers flow in valleys with steep gradients. Major rivers of the Peninsula are Mahanadi, Godavari, Krishna, and Cauvery. The Narmada and Tapti flow westwards.

INDIA	
State	Capital
Andhra Pradesh	Hyderabad
Arunachal Pradesh	Itanagar
Assam	Dispur
Bihar	Patna
Chhattisgarh	Raipur
Goa	Panaji
Gujarat	Gandhinagar
Haryana	Chandigarh
Himachal Pradesh	Shimla
Jammu & Kashmir	Srinagar
Jharkhand	Ranchi
Karnataka	Bengaluru
Kerala	Thiruvananthapuram
Madhya Pradesh	Bhopal
Maharashtra	Mumbai
Manipur	Imphal
Meghalaya	Shillong
Mizoram	Aizawl
Nagaland	Kohima
Odisha	Bhubaneshwar
Punjab	Chandigarh
Rajasthan	Jaipur
Sikkim	Gangtok
Tamil Nadu	Chennai
Telangana	Hyderabad
Tripura	Agartala
Uttarakhand	Dehra Dun
Uttar Pradesh	Lucknow
West Bengal	Kolkata
UNION TERRITORIES	
Delhi - National Capital Territory	Delhi
Andaman & Nicobar Is.	Port Blair
Chandigarh	Chandigarh
Daman & Diu	Daman
Dadra & Nagar Haveli	Silvassa
Lakshadweep	Kavaratti
Puducherry	Puducherry
INDIA	Delhi

Fig: India , state and capital

## **1.4 THEORIES BEHIND THE ORIGIN OF HIMALAYAS**

The Himalayas, one of the youngest mountain ranges of the world are vast, extensive, and the loftiest. It passes through five nations: India, Pakistan, Bhutan, China and Nepal. The Himalayas stretches for nearly 2500 km. (over 22° longitude),with a width of 150 km to 400 km from Nanga Parbat (8126 m) in Kashmir in the west to Namcha Barwa (7755 m) in Arunachal Pradesh in the east. i.e. from the Indus gorge in the west to the Brahmaputra gorge in the east. The total area of the Himalayan mountain range is nearly five lakh sq km and it extend eastward in the form of an arcuate curve which convex to the south. It is the world's tallest mountain range. In addition to Mount Everest, the world's tallest mountain peak, standing at an elevation of 8,848 meters, the range also features several other mountain peaks over 8,000 meters. It has 281 peaks.

#### • Origin of Himalayas

Scholars have given divergent **views regarding the origin of the Himalayas.** These views may be grouped under the following three categories:

- (a) Geosynclinals evolution,
- (b) Plate tectonics, or
- (c) Vertical movements

#### (a) Geosynclinals Evolution

The geosynclinals origin of the Himalayas has obtained maximum approval from the scholars. The theories of Suess, Argand, and Kober etc. all belong to this category. According to geologists the disintegration of Pangaea led to the formation of a long Mediterranean sea (called Tethys) between the two land masses of Laurasia or Angaraland (north) and Gondwanaland (south). In between Laurasia and Gondwanaland, there was a long, narrow and shallow sea called Tethys Sea. This sea was occupying the region of the Himalayas during the Mesozoic era (180 my.) During the end of the Palaeozoic era and beginning of the Mesozoic era the Tethys almost engirdled the whole earth running from Europe in the west to China in the east. Eroded material from the two land masses that were deposited in the Tethys assumed considerable thickness due to the sinking nature of the bed of the sea. These sediments were subjected to the powerful compression force from both the continents, this compression squeezed and crushed the sediments of Tethys and series of folds were formed one behind the other giving rise to the Himalayas. (Fig: 1.4) The

curved shape of the Himalayas convex to the south, is attributed to the maximum push offered at two ends of the Indian peninsula during its northward drift. In the northwest it was done by the Aravalis and in the northeast by the Assam Ranges. During Cretaceous period the bed of the sea started rising which led to the folding of three successive ranges of the Himalayas, running more or less parallel to one another.

The first upheaval, about 120 million years ago, which led to the formation of the Greater Himalaya, took place during Eocene period. Similarly second upheaval during Miocene period about 20 to 30 million years ago folded the Lesser Himalayas and third starting in Pliocene period about two million to twenty million years ago, ended with the birth of the Siwalik Hills. Recent studies shows that India is moving northward at the rate of about 5 cm per year and crashing into rest of the Asia, buckling the Himalayas between Angaraland and Gondwanaland. This drift is providing instability to the Himalayan region.



Fig: Formation of Himalaya

#### (b) Plate Tectonics

According to the plate tectonics **the collision of the Indian plate with its Asian counterpart has given rise of the Himalayas**.(Fig:1.5). This has resulted into the seduction of the northern margin of the Indian plate,(Fig:1.6) crustal shortening, folding of the upper silica material, pilling up of nappes and isostatic recovery.

# These views are supported by the following features of the Himalayas:

- (i) **Flysch occurs** along the Indus-Tsangpo and Shyok-Kailash zones,
- (ii) The **low angle MCT (Main Central Thrust**) separates the central crystallines from the meta- sedimentaries which occur below the thrust and are pre-Cambrian to lower Palaeozoic in age. Then Tethyan marine sediments occur over the central crystallines,
- (iii) The klippen and windows were also taken to support largescale thrusting,
- (iv) **The MBT (Main Boundary Thrust)** separates the Pre-Cambrian Mesozoic metamorphics and sediments from the Tertiary deposits. Above facts suggest crustal shortening in the Himalayas which followed crustal consumption at the edges and the intercontinental collision along the Indus-Suture zone.

#### (c) Vertical Movements

Those who advocate vertical movements responsible for the upliftment of the Himalayas take support from the fact that the gravitational force, the main force among the various bodies in space, can act only radially inhibiting enormous horizontal translocation implicit in plate tectonics.

The facts in the Himalayas supporting this view include the high angle inclination of the MBT; absence of distinct root zones and possible occurrence of granite domes in various areas (E. Ahmad, 1992, pp. 21-22).

There are numerous evidences to show that the Himalayas are still rising and the process of uplift is not completed. The present rate of uplift of the Himalayas has been calculated at 5 to 10 cm per year.

# Following are some of the evidences which prove that the Himalayas are still rising:-

- Some of the **fossils found** in the Siwalik Hills are also observed in the Tibet Plateau. It indicates that the altitude of the Tibetan plateau was same as that of present Siwalik Hills.
- The **frequent earthquakes** in the Himalayan region show that the Himalayas have not yet attained the isostatic equilibrium and they are still rising.
- Earlier the **height of the Mount Everest** was measured 8,848 meters, but according to the measurements made by the National Geographic Society (Washington) using GPS satellite equipment on May 5, 2000, the height of the peak is 8850 mt determined by the trigonometrical methods indicate that the Himalayas continue to rise till date.

# **1.5. PHYSIOGRAPHIC DIVISIONS OF HIMALAYA**

# • The Northern Mountain:

The Northern Mountain is divided into three groups. They are:

- (1) The Himalayas
- (2) The Trans Himalayas
- (3) The Purbanchal hills

## 1. The Himalayas may be divided on the basis of

- A. The four east west extended parallel ranges,
- B. The Regional Characteristics

# They are discussed below:

- A. The Himalayas consist of four parallel ranges from South to North. They are as follows:
- i. The Outer Himalayas Or The Siwalik
- ii. The Lesser Himalayas Or Himachal Himalaya:
- iii. The Greater Himalaya (The Himadri)
- iv. The Trans Himalaya Or The Tibetan Himalaya
- A. The four east west extended parallel ranges of the Himalayas are discussed below:
- i. The Outer Himalayas or the Siwalik
- It is the outer most or the southernmost range of the Himalayas.

- Its average height is over 1000m(600-1500m)
- Length about 2400 km.
- The width lies between 10 to 50 KM.
- It is non-existent between the eastern boundary of Nepal and the river Torsa in Bhutan.
- It is almost continuous range of low hills, like, Jammu Hills, in Jammu, Dafla, Mirrey, Abor, Mishmi in Arunachal Pradesh, and Dhyang in Uttaranchal, etc.
- This range is composed of unconsolidated tertiary sediments emerged as most recent phase in Himalaya orogeny.
- The flat floored structural valleys lying between Siwalik and Lesser Himalayas (Himachal) are called 'Duns' like Dehra Dun, Kotli Dun, Patli Dun and Choukhamba Dun.

#### ii. The Lesser Himalayas or Himachal:

- The range lies to the north of the Siwaliks.
- The altitude of this range lies between 2000 and 5000 metres and the average width is 50 KM (60-80Km)
- It generally consists of unfossiliferous sediments or metamorphosed crystalline.
- Important range include the Dhauladhar, Pirpanjal, Nagtibba,Mahabharat and Mussoorie range in the Western Himalaya. In the Eastern Himalayas, the ranges of the Himachal runs in a north-south direction such as the Singalila, the Dongkya etc.
- It comprises of many famous hill stations like Shimla, Dalhousie Darjeeling, Chakrata, Mussoorie, Nanital etc.
- It also comprises of famous valleys like Kashmir, Kullu, Kangra etc.
- Pass Bundilgir, Banihal
- Longest tunnel of Asia (23/5Km long), Jawahar tunnel lies in this region

#### iii. The Greater Himalaya (The Himadri)

- The Greater Himalayas or Himadris the most continuous, longest, loftiest and northern most range of Himalayas.
- Lying in the extreme north extending from Nanga Parbat in the west to Namcha Barwa in the east is known as Himadri as many snow capped mountain peaks adorn this range.
- The Greater Himalayas comprises of the northern most ranges and peaks. It has an average height of 6000 metres and width

lies between 120 to 190 Kms. It is the most continuous range. It is snow bound and many glaciers descend from this range.

- It has high peaks like Nanga Parbat (8126 mt) in Jammu and Kashmir, Kedarnath (6940 mt), Badrinath (7138mt), Kamet (7756mt), Nandadevi (7817 mt) in Uttarakhand. Mt. Everest (8848 m), located on the Nepal-China border, is the highest peak of the world and Kanchenjunga (8598m)in Sikkim, is the highest peak of Himalaya in India. Makalu, Dhaulagiri are other peaks.
- High Mountain passes also exist in this range, namely, Bara Lacha-La, Shipki-La, Nathu-La, Zoji-La, Bomidi-La etc.
- The Ganga and Yamuna rivers originate from this Himalayas.

# iv. The Trans Himalaya or the Tibetan Himalaya or Tethys Himalaya.

- There are three more mountain ranges to the north o the Great Himalayas in India.
- They are the Zaskar the Ladakh and the Karakoram range.
- It extends north of greater Himalaya and parallel to it is called Zaskar range.
- Highest peak of Zanskar is Leopargel (7420m)
- North of Zaskar range lies Ladakh range.
- The Indus river flows between Zaskar and Ladakh range.
- The Ladakh range stretches for 350 km with several peaks above 6000m.
- To the north east of Ladakh range lies the Ladakh plateau (above 4000m), the highest plateau of India, which is a cold desert.
- To the north of the Ladakh range lies the Karakoram range.
- Mount Godwin Austin (8611 mt) or K<sub>2</sub>(King of Karakoram) of the Karakoram Range is the second highest peak of the world and the highest mountain peak of India.
- India's longest glacier Siachen (more than 70 km long) is on the Karakoram range.
- The Karakoram Range lie extreme north of the country.

#### 3. Purbachal or the Hills of the North Eastern India:

 Encircling the Namcha Barwa the Himalayan Ranges take a sharp bend to the south and run in north – eastern border of India.

- The North-Eastern Himalayas run North to South through Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and eastern Assam.
- Of these ranges Mishmi, Patkoi, Naga, Lushai, Mikir, Barail and Mizo hills predominate the landscape, which are located in eastern side.
- The highest peak of the Naga hill is Saramati.
- The famous Logtak Lake in the Imphal Valley is located in Manipur.
- The Meghalaya (meaning abode of clouds) plateau isa high plateau. It is dissected into hills, which includes the hills of Garo, Khasi and Jaintia.
- Meghalaya Plateau is an extension of the Deccan Plateau. The land between the Rajmahal Hills and the Meghalaya Plateau subsided due to the earth movements.

# B. On The Basis Of The Regional Characteristics The Himalayas Can Be Divided Into Three Sub-Regions:

- 1. Western Himalayas
- 2. Central Himalayas
- 3. Eastern Himalayas

#### 1. Western Himalayas may be grouped into three sub regions:

- a. Kashmir Himalayas
- b. Himachal Pradesh Himalaya
- c. Kumaun or Uttarakhand Himalaya

# • The sub-divisions of Western Himalayas are discussed below:

**a. Kashmir Himalayas** : It belongs to the state of Jammu and Kashmir. To the extreme south stands the Jammu and Punch Hills. Further north is the Pirpanjal range. To the north of Pirpanjal lies the famous Kashmir Valley which is bordered on the north by Himadri and Zanskar Ranges. Further north lies the Indus Gorge. To the extreme north stands the Karakoram range, where K<sub>2</sub> is the highest peak

**b. Himachal Pradesh Himalaya** : It belongs to the Himachal Pradesh. To the extreme stands the Siwalik range. Further north stands the lesser Himalaya ranges namely Pirpanjal, Nagtibba, Dhauladhar

**c. Kumaun or Uttarakhand Himalaya** : It belongs to the state of Uttarakhand. To the extreme south some famous valleys like Duns, namely Dehradun, Choukhamba. To the north of these stands the Nagtibba and Mussourrie range. Further north, snow capped peaks like Nanda devi, Gangotri, Kedarnath are found.

2. CENTRAL Himalaya: belong to the country Nepal and include many lofty peaks, namely Mt Everest, Annapurna, Dhabalgiri.

3. Eastern Himalayas lies to the east of Nepal and can be subdivided into three subdivisions:

- d. Sikkim Darjiling Himalaya
- e. b. Bhutan Himalaya
- f. Assam or Arunachal Himalaya

**d. Sikkim Darjiling Himalaya**: Singalila, Dowhill, Donkia are three important ranges of this region.Kanchenjunga, which belongs to the Sikkim Himalaya, the third highest peak of the world and the highest peak of Himalaya in India, lies here.

**e.** Bhutan Himalaya : Topography of this region is very rugged. Kula Kangri(7554 m) is the highest peak of this region.

**f. Assam or Arunachal Himalaya**: It belongs to the Arunalachal Pradesh. Siwalik range stands to the north of Brahmaputra valley. Further north stands the Lesser Himalaya and to the extreme north stands the Great Himalaya.



Fig: Origin of Peninsular plateau and Himalaya

# **1.6. ORIGIN OF THE PENINSULAR PLATEAU**

The **peninsular plateau is a triangular shaped table land.** It is part of ancient land mass called Gondwana level. It covers an area of nearly 5 lakh sq.km. It is spread over the states of Gujarat, Maharashtra, Bihar, Karnataka and Andhra Pradesh.



Fig Plateaus of India

- According to the geologists the origin of rocks of Peninsular India is more than 3600 million years old.
- It was a part of the Gondwanaland before the Carboniferous period.
- They also opined that during the Archaean Period, the Indian Peninsula never subsided under the sea permanently.
- It was more rigid, stable and had remained almost unaffected by the mountain building forces.
- It 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.

# 1.7. PHYSIOGRAPHY AND RELIEF FEATURES OF PENINSULAR INDIA:

Covering an **area of about 16 lakh sq km**, the peninsular upland forms the **largest physiographic division of India**.

- With a **general elevation between 600-900 metres**, the region constitutes an irregular triangle with its base lying between the Delhi Ridge and the Rajmahal Hills and the apex formed by Kanyakumari.
- It **is bounded by** the Aravallis in the north-west, Maikal Range in the north, Hazaribagh and Rajmahal Hills in the northeast, the Western Ghats (SahayadriMountains.) in the west and the Eastern Ghats in the east.
- The highest peak of Peninsular India-Anai-Mudi (Nilgiris), is 2695 metres above sea level.
- According to Prof. S. P Chatterji (1964), the Peninsular Uplands can be divided into the following physiographic units

# ✤ <u>The broad Physiographic Regions of Peninsular India</u> <u>are as follows</u>:

- 1. Central Highlands
- 2. The Eastern Highlands (Plateau)
- 3. Deccan Plateau

#### 1. The Central Highlands are divided into

# a. The North Central Highlands and b. The South Central Highlands

a. The North Central highlands of peninsular India is again divided into

## i. The Aravallis,

## ii. The Malwa Plateau

#### (i) The Aravallis:

It is one of the oldest fold mountains of the world that runs from north-east to south-west for about 800 km between Delhi to Palanpur (Gujarat). Guru-Sikhar (1722 metres,) on Mount Abu is the highest peak is of Aravalli. The Aravillis are mainly composed of quartzites, gneisses and schists of the Precambrian period.

#### (ii) The Malwa Plateau:

The Malwa plateau is located to the north of Vindhya and is composed of pink granite. It is bordered by the Aravallis in the north, the Vindhyan Range in the south and the Bundelkhand Plateau in the east. The highest peak of Vindhya is Manpur (881m). Vindhya is the source of river Chambal. The Malwa Plateau has two drainage systems, one towards the Arabian Sea (Narmada, and Mahi), and another towards the Bay of Bengal (Chambal, Sind, Betwa and Ken) joining the Yamuna river.

#### b. The South Central Highlands

The Vindhyan Range extends from Jobat (Gujarat) and Chittorgarh (Rajasthan) to Sasaram in Bihar. It extends for about 1050 km with general elevation between 450 to 600 metres. Apart from the Kaimur Hills in the east, the Maikal Range forms a connecting link between the Vindhyans and the Satpura mountains.

# • The South Central Highlands include the following divisions

## i. The Bundelkhand:

It is bounded by the Yamuna river in the north, the Vindhyans in the south, the Chambal in the north-west and Panna-Ajaigarh Range in the south-east. The rivers like Betwa, Dhasan and Ken have carved out steep gorges, rapids, cataracts and waterfalls.

#### ii. The Vindhyachal-Baghelkhand or Vindhyachal Plateau:

This plateau has an elevation varying between 150 to 1200 metres. To the south of this lies the Narmada-Son trough (rift valley). Narmada flows through this rift valley in an east to west direction. Besides the Narmada and Son, this region is drained by the Karmanasa, Tons, Ken and Belandare rivers.

Parallel to the Vindhyas between the Narmada and the Tapi rivers is the Satpura Range. Satpura consists of Rajpipla Hills, Mahadev Hills and the Maikal Range. Dhupgarh (1350 m, near Pachmarhi) is the highest peak of Satpura. Amarkantak (1064 metres) is another important peak of the Satpura mountains.

# 2. The Eastern Highlands (Plateau) includes

- i. The Chotanagpur Plateau
- ii. The Meghalaya-Mikir Uplands
- i. The Chotanagpur Plateau

The Chotanagpur Plateau sprawling over parts of West Bengal, Jharkhand, Chhattisgarh, Orissa and north-eastern part of Andhra Pradesh, has a series of the meso and micro plateaux (Ranchi, Hazaribagh, Singhbhum, Dhanbad, Palamu, Santhal, Parganas and Puruliya districts of West Bengal). The highest general elevation of the Chhotanagpur Plateau is about 1100 m. The mid-western part is known as pat lands. Chhotanagpur Plateau is drained by Barakar, Damodar, Subarnarekha, Koel rivers. These rivers have carved out deep gorges, rapids, cataracts, and waterfalls in the plateau region.

## ii. The Meghalaya Plateau and Mikir Hills

It is a plateau which has been detached from the Indian Peninsula by the Malda Gap. It consist of the Garo, Khasi, Jaintia hills and the outlying Mikir and Rengma hills. The Shillong Peak is the highest elevation (1823 m) in the Meghalaya Plateau, while Norkek (1515 m) is the highest peak of the Garo Hills, Mawsynram (25°15'N, 91°44'E) about 16 km west of Cherrapunji records the highest rainfall in the world. The Mikir Hills are detached from the Meghalaya Plateau and are surrounded by plains from three sides. The southern range of the Mikir Hills is known as the Rengma Hills (900 m). The Mikir Hills are characterised by radial drainage with Dhansiri and Jamuna being the main rivers.

#### 3. Deccan Plateau

The Deccan Plateau is **the largest plateau of India**. It is composed partly of Lava flows, basalt and granite. On weathering the plateau has become a rolling upland with shallow valley together with a few flat topped structural uplifts. The Deccan Plateau is bounded on the east by the Eastern Ghats and on the west by Western Ghats.

# The Deccan Plateau comprises the following physiographic divisions:

- i. The North Deccan
- ii. The South Deccan
- iii. The Western Ghats or Sahayadri
- iv. The Eastern Ghats
- i. The North Deccan is further subdivided as follows:

#### a. The Maharashtra Plateau:

- The plateau of Maharashtra includes the entire state of Maharashtra, except the Konkan coast and the Sahyadris.
- It is mainly covered by the basalt of the Cretaceous Period.
- The basaltic sheet has a thickness of about 3 km in the western part which diminishes towards the east and south-east.
- The most striking feature of the Maharashtra Plateau is the fault (1000 metres), giving rise to the present shoreline of the Arabian Sea.
- Through the northern part of the Maharashtra Plateau flows the Tapi River from east to west.
- It has a gentle slope in the south and steep gradient in the north (towards the Satpura Hills).

#### (b) The Mahanadi Basin or the Chhattisgarh Plain:

- Sprawling over the districts of Raipur, Bilaspur, Durg and Rajgarh it is the only plain worth the name in the vast stretch of plateaus and hill ranges of the Peninsular plateau.
- It is a saucer shaped depression drained by the upper basin of the Mahanadi.
- The whole basin lies between the Maikal Range with crest line of 700-900 metres and the Orissa hills.
- The southern rim land includes the Dhalli-Rajhara Hills in southern Durg district and the Raipur uplands in the south-eastern Raipur district.

# (c) Garhjat Hills or the Orissa Highlands

- It is an undulating plateau, bordered by the Chotanagpur Plateau in the north, Mahanadi basin in the west, Eastern Ghats in the south and Utkal plains in the east.
- It is drained by the Tel and Udanti; tributaries of Mahanadi, and the Sabari and Sileru; tributaries of Godavari rivers.

Fig.1.46 Rivers that drain the Peninsular India

## ii. The South Deccan

The South Deccan consists of several plateaux:

## a. Karnataka Plateau:

- This plateau has an average elevation of 600-900 metres, spans in the state of Karnataka and the Cannanore and Kozhikode districts of Kerala.
- Mulangiri (1913 metres) is the highest peak in Baba-Budan Hills, followed by the Kudermukh (1892 metres) peak.
- The northern upland of the Karnataka plateau is known as Malnad, while the southern part is called a Maidan.
- It is drained by the Kaveri and the Tungbhadra rivers.

#### b. The Telengana Plateau:

Hyderabad, the capital and cultural city of the state lies in Telengana.

# c. The Tamil Nadu Uplands:

- This upland lies between the South Sahyadri and Tamil Nadu coastal plains.
- Between Coimbatore and Anaimalais, there is a broad gap, known as Palakkad Gap (Palghat), about 25 km wide, through which flows the Gayitririver from east to west joining Tamil Nadu with the coast of Kerala.



Fig: Sahyadri major water divide

## iii. The Western Ghats

• The Western Ghats or Sahyadris are block mountains that run parallel to the western coast for about 1600 km in the north south direction from the mouth of the Tapi river to Kanyakumari (Cape Camorin).

- The western slope of Sahyadri is steep while the eastern slope is gentle.
- The Sahyadris form a watershed of the peninsula.
- Rivers like the Godavari, Krishna and Kaveri rise from the Western Ghats.
- The highest waterfall in India, Gersoppa (Jog Falls) on Sharvatilies here.
- The average elevation of the Western Ghats varies between 1000 to 1300 metres.
- The important peaks of the Western Ghats are Kudermukh (1892 m), Pushpagiri (1714 m), Kalsubai (1646 m) and Salher (1567 m), Mahabaleshwar (1438 m) and Harishchandra (1424 m).
- In the Nilgiris the Eastern Ghat joins the Western Ghat to form a mountain knot (Nilgiri) whose highest point is Anaimudi (2695 m).
- South of Nilgiri lies the Palghat (Palakkad Gap).
- South of Palghat, the Western Ghat is known as Anaimalai Hills.
- Anaimudi, the highest peak of Sahayadris, is 2695 m above the sea level. The other important passes of the western Ghat are Thal Ghat (joins Nasik with Mumbai) and Bhor Ghat. (Joins Mumbai with Pune), Goran Ghat, Lying to the south of Mount Abu, connects the city of Udaipur with Sirohi and Jalore in Rajasthan. Haldighat: It is a mountain pass in the Aravalli range of Rajasthan. Harishchandra: It joins the state of Tamil Nadu with the seaports of Kerala

#### iv. The Eastern Ghats

- The Eastern Ghats with an average height of about 600 m form the eastern boundary of the Deccan Plateau.
- It is a massive outlying block of hills. The
- The peak of Aroya-Konda (Andhra Pradesh,1680 metres) is the highest peak of the Eastern Ghats.
- Dewodi-Munda (1598 m), Singa-Raju (1516 m) and Nimalgiri (1515 m) in the Koraput District and Mahendragiri (1501 m) in Ganjam District are the other important peaks.

# **1.8. THE ORIGIN OF INDO GANGETIC PLAIN**

Great Plains of India, also known as the Indus-Ganga-Brahmaputra plains, extends for a distance of about 3200 km and its width varies from 150 km to 300 km. It is the largest aggradational plain of India. It lies to the south of the Himalayas and north of the Peninsular India. The plain appears as a great alluvial crescent stretching from the Indus River system in Pakistan to the Punjab Plain, in both Pakistan and India and the Haryana Plain to the delta of the Ganga, in Bangladesh (where it is called the Padma).

Topographically the plain is homogeneous. Floodplain bluffs and other related features of river erosion and changes in river channels form important natural features in some places.

The plain was formed as a result of filling of marine depressions by detrital materials brought by river. Plains were formed after the upliftment of Himalayas. Majority of this plain consists of alluvial soils.

# 1.9. PHYSIOGRAPHIC DIVISIONS OF THE GREAT PLAINS OF INDIA

The Great Plains of India is a remarkably **homogeneous** surface with an imperceptible slope.

The Great Plains of Northern India may be divided into the following Physiographic divisions:

- 1. Rajasthan Plain
- 2. Sutlej Plain
- 3. Ganga plain
- 4. Brahmaputra Valley



# **Fig: North Indian Plains**

## Salient Features of Rajasthan Plain are as follows:

- The region slopes from the east to the west into the Indus Valley and to the south into the Rann of Kutch.
- It rises over 325 m in the east while drops to 150 m in the west.
- It is extensively a sandy plain.
- It experiences extreme type of climate because of which River Luni the only of this region is a saline river.
- There are a few saline lakes namely Panchpadra, Didwana, Sambhar.
- The dry shallow channels or lakes are called "Dhand"
- Shifting dunes found here are locally called "Dhrian"

# Physiographically the Rajasthan Plain may be divided into three sub-divisions:

- I. Marusthali : a desert with shifting sand dunes, dhrian
- II. Bagar : A grassland located to the east of the Marusthali

- III. **Rohi** : a fertile plain made by small streams located to the east of bagar
- Salient Features of Sutlej plain are as follows:
- The new alluvium deposited near the banks of the rivers Sutlej, Beas, Ravi, and Chenub forming a plain is called "Bet."
- Average elevation 200 to 240 m
- The plain is formed by the silt deposited by the river Sutlej, Beas, Ravi and Chenab.
- It is a very fertile plain especially in the Bari Doab between the Beas and the Ravi and the Bist Doab between the Beas and the Sutlej.
- Flood Plain is known as "Dhaya" and the eroded Plain is known as "Chos"
- Salient Features of the Ganga plain are as follows:
- This is an extensive plain comprising nearly 3,75,000sq Km. in Uttar Pradesh, Bihar and West Bengal.
- It is a monotonous plain with scattered hills and levees.
- The largest delta of the world has formed at the mouth of river Ganga to the south eastern part of the region.
- The region slopes from west to the east and south east.
- The old alluvium is known as "Bhangar"
- The new alluvium is known as "Khadar"
- To the north of this plain is stony "Bhabar", located at the Himalayan foot hills.
- To the south of Bhabar lies "Terai", a narrow humid region.
- Physiographically the Ganga plain may be divided into three sub-divisions:
  - I. The Upper Ganga Plain
  - II. The Middle Ganga Plain
- III. The Lower Ganga Plain
- i. The Upper Ganga Plain
- Extends from the river Yamuna from the west upto the confluence at Ganga and Yamuna near Allahabad in the east with a height of100-250 m.
- The Upper Ganga Plainis sub-divided into

- a. Rohikand Plain
- b. AwadhPlain
- c. Ganga and Yamuna Upper and Lower Doab
- d. Yamunapar Plain

## ii. The Middle Ganga Plain

Stretching from Allahabad in the west to Rajmahal in the east with a height of about50- to 100m.

#### iii. The Lower Ganga Plain

- Stretches from Rajmahal hills to the Bay of Bengal with an elevation of 4 to 50m.
- The whole of West Bengal except the Puruliya district and the northern mountains comprises the Lower Ganga Plain.

## The Lower Ganga Plain is Sub divided into

## a. The North Bengal Plain-

North Bengal Plains lying in Uttar Dinajpur, Dakshin Dinajpur and Malda form a part of the old Ganga Delta and is known as "Barind"

## b. South Bengal Plains

The vast alluvial plain of the southern part of Bengal extends southwards from the southern bank of the Ganga to the shores of the Bay of Bengal.

- South Bengal Plains is again sub-divided into:
- I. Moribund delta
- II. Mature Delta
- **III. Active Delta**
- Salient Features of Brahmaputra Valley:
- Elongated narrow plains bounded by hills in the north, east and south
- The plain slopes from the east (130m) to the west (30 m)
- The river Brahmaputra flows in a braided course
- There are many sand banks and river islands in the river Brahmaputra

- Majuli island is the largest river island of the world is found in the river Brahmaputra
- The northern part of this plain lying on the foothills of the Himalaya composed of sand stones and pebbles called Terai.
- The Great Plains of India may be divided into the following sub-regions on the basis of regional characteristics:

#### 1. The Bhabar Plain

It lies to the south of the Siwalik from west to east i.e. from Jammu Division to Assam, having a width more in the western plains than in the eastern plains of Assam. In width, the **Bhaba**r tract is generally 8 to 15 km, consisting of gravel and unassorted sediments deposited by the rivers descending from the Himalayas and the Siwalik. **The porosity of this tract is very high** and so most of the small streams (chos and raos) disappears in the Bhabar tract. The Bhabar tract is not suitable for cultivation of crops.

## 2. The Tarai Tract

- The Tarai belt which is a marshy tract, 15-30 km wide, lies south of the Bhabar tract.
- The Tarai is wider in the eastern parts of the Great Plains, especially in Brahmaputra Valley.
- This zone is characterised by excessive dampness, thick forests, rich wild life and malarial climate.
- In Uttarakhand, Uttar Pradesh, Haryana, Punjab, and Jammu Divisions (J & K) the Tarai forests have been cleared for cultivation of crops.
- Disappeared rivers of Bhabar region appear again in Terai region and make this region a flood prone one.

## 3. The Bhangar (Bangar) Plains

- The Bhangar land lies above the flood limits of the rivers. It is the higher part of the plains.
- The Bhangar or older alluvial plain, represent the upland alluvial tracts of the Great Plains of India, formed by the older alluviums.
- The Bhangar formations were deposited during the middle Pleistocene Period.
- The soil is dark in colour, rich in humus content and productive.
- It contains concretions and nodules of impure calcium carbonate or Wankar'.

- In relatively drier areas, the Bhangar also exhibits small tracts of saline and alkaline efflorescences known as "Thue".
- Bhangar is generally a well drained and the most productive land of the Great Plains of India.
- The Bhangar deposits have the fossils of elephants, horses, man, rhinoceros, hippopotamus, etc

#### 4. The Khadar Plains

- The new alluvium tracts along the courses of the rivers are known as the "Whadar" or 'Bet' lands.
- The khadar tracts are enriched by fresh deposits of silt every year during the rainy season.
- The Khadar land consists of sand, silt, clay and mud.
- Most of the Khadar land has been brought under cultivation after independence. This land has been devoted to sugarcane, rice, wheat, maize, oilseeds, legumes, and fodder crops.
- The Khadar deposits have the fossils of living species like man, deer, oxen, buffaloes, horses, elephants, rhino, etc.

#### 5. Delta Plains

- The deltaic plain is an extension of the Khadar land.
- It covers about 1.9 lakh sq km of area in the lower reaches of the Ganga River.
- In fact, it is an area of deposition as the river flows in this tract sluggishly.
- The deltaic plain consists mainly of old mud, new mud and marsh.
- In the delta region, the uplands are called 'Chars'.
- The delta of Ganga being an active one, is extending towards the Bay of Bengal.
- These are very fertile and are suitable for jute & rice cultivation. For example: The Ganga-Brahmaputra delta, spread in India and Bangladesh.

# 1.10. THE COASTAL PLAINS

#### Introduction

The Plateau of Indian Peninsula is fringed by narrow coastal plains of varied width from north to south, known as the **West-Coastal Plains on the west and the East Coastal Plains on the east.** The West-Coastal Plains and the East Coastal Plains are washed by the Arabian Sea on the west and by the Bay of Bengal on the east respectively. They were **formed by the depositional action of the rivers and the emotional and depositional actions of the sea-waves** and differ from each other.

#### Origin of The Coastal Plains

India has a coastline of 7516.6 Km (6100 km of mainland coastline, 1197km. coastline of Indian islands) touching 13 States and Union Territories.

According to geologists the origin of the western and eastern coasts of India may be attributed to the faulting and subsidence of the Arabian Sea and the Bay of Bengal towards the close of the Eocene Period. Consequently, alluvial deposits along these coasts are of very recent origin, ranging from Pliocene to recent times. These coastal plains have the evidence of submergence and emergence. The straight and regular coastline of India is the result of faulting of the Gondwanaland during the Cretaceous period.

The west coast of India is both emergent and submergent.

The northern portion of the coast is submerged as a result of faulting and the southern portion, that is the Kerala coast, is an example of an emergent coast.

The east coast of India, especially its south-eastern part (Tamil Nadu coast), appears to be a coast of emergence.

# 1.11. THE PHYSIOGRAPHY OF INDIAN COASTAL PLAINS

According to their location to the east or west of the peninsular, Indian coastal plains may be divided into two broad physiographic divisions:

- 1. The Western Coastal Plains
- 2. The Eastern Coastal Plains
- 1. The Western Coastal Plains :
- Lying between the Western Ghats and the Arabian Sea, the west coast strip **extends** from the Gulf of Cambay or Gulf of Khambhat in the north to Cape Comorin or Kanyakumari in the south.

- It is **made up of alluvium** brought down by the short streams originating from the Western Ghats.
- The western coastal plain of India is situated on a thin strip of land.
- It is about 1400 km long and 10 to 80 km wide.
- The west coastal plain becomes **narrower gradually from the Kutch coast to Kanyakumari.**
- The western coastal plains cover an area of about 64,284 square kilometre
- It has an **elevation up to 150 m above sea level**, reaching more than 300 m at places.
- The Western Coastal Plain (Fig.1.54)is **characterised** mainly by sandy beaches, coastal sand-dunes, mud-flats, and lagoons, alluvial tracts along rivers, estuary, laterite-platforms and residual hills.
- The west coast has short rivers coming down swiftly from the western slopes of the Western Ghats, the draining into the Arabian Sea without forming any deltas.
- The estuaries, of the Narmada and the Tapi are the major ones.
- The west coast of India, on the other hand, is both emergent and submergent.

Starting from north to south, the Western Coastal Plains is divided into the following sub-divisions:

- a. Kutch Peninsula
- b. Kathiawar Peninsula
- c. The Gujarat Coastal Plain
- d. The Konkan Coastal Plain,
- e. The Karnataka Coastal Plain
- f. The Kerala or Malabar Coastal Plain
- 1. a. Kutch Peninsula
- Kutch and Kathiawar, though an extension of Peninsular plateau (because Kathiawar is made of the Deccan Lava and there are tertiary rocks in the Kutch area), they are still treated as integral part of the Western Coastal Plains as they are now levelled down.
- Kutch, formerly an island, is almost surrounded by the Rann except in the south-west

- All along the Kutch Peninsula there lies a broad level of salt soaked marshy land known as the Great Rann.
- Salt-soaked plain to the north of Kutch is the Great Rann. Its southern continuation, known as the Little Rann lies on the coast and south-east.
- The salt in the soil makes this low-lying marshy area almost barren and unproductive.
- The Rann of Kutch is an extensive tract of naked tidal mudflats transacted by abandoned and live creeks.
- The Gulf of Kutch separates the Rann of Kutch from the Kathiawar Peninsula.
- These seas and lagoons were later filled by sediment brought by the Indus River which used to flow through this area.
- Lack of rains in recent times has turned it into arid and semiarid landscape.

The Luni drains into the Rann of Kutch.

#### 1. b. Kathiawar Peninsula

- The Kathiawar Peninsula lies to the south of the Kutch
- Is a plain level land
- Northern part is a rolling upward
- Central part is dissected into hills.
- The coastal areas are sandy.
- The highest point is mount Girnar (1117m) of the Gir Range in central Kathiawar

• The central part is a highland of Mandav Hills from which small streams radiate in all directions (Radial Drainage). Mt. Girnar (1,117 m) is the highest point and is of volcanic origin.

• The Gir Range is located in the southern part of the Kathiawar peninsula. It is covered with dense forests and is famous as home of the Gir lion.

#### 1. c. The Gujarat Coastal Plain

- Broadest part of the Western Coastal Plain
- The Gujarat plain **covers** almost the entire state of Gujarat, except the districts of Banaskantha and Sabarkantha.
- It is **formed** by the alluvial deposits of Sabarmati, Luni, and numerous tiny parallel consequent streams.

- **Origin**: Part of this plain is the product of depositional activity of the winds and recession of the sea.
- It **contains** the Gondwana rocks (Umia Series), resting over the marine Jurassic rocks and capped by Lower Cretaceous beds. The Deccan lava lies over the Umia series.
- The eastern section of Gujarat Plain is a projected jet of Sindhu-Ganga alluvial tract in Peninsular India. This projection is the outcome of an extensive Pleistocene sedimentation.
- The Gujarat Plain lies east of Kutch and Kathiawar and slopes towards the west and south west.
- Formed by the **rivers Narmada, Tapi, Mahi and Sabarmati**, the plain includes the southern part of Gujarat and the coastal areas of the Gulf of Khambhat.
- The eastern part of this plain is fertile enough to support agriculture, but the greater part near the coast is covered by windblown loess (heaps of sand).
- 1. d. The Konkan Coastal Plain
- The northern part of the west coastal plain, known as the Konkan Plain, is about **530 km long and 30 to 50 km wide**
- Lies in Maharashtra, stretching from Daman in the north to Goa in the south.
- Narrow and broken region.
- Coastline of submergence
- It has some **features** of marine erosion including cliffs, shoals, reefs and islands in the Arabian Sea.
- The Thane creek around Mumbai is an important embayment (a recess in a coastline forming a bay) which **provides an excellent natural harbour.**
- No other coastal plain of India is so narrow.
- Most of the plain is formed of rock.
- Through the northern part of this coast flows the Baitarani River.
- Konkan coast (Maharashtra and Goa Coast) is a Coastline of submergence.

#### 1. e. The Karnataka Coastal Plain

- Southward is the Karnataka coastal plain which is about 525 km long and 8 to 25 km wide. It is the narrowest part of the West coastal plain.
- Goa to Mangalore.
- It is a narrow plain with an average width of 30-50 km, the maximum being 70 km near Mangalore.
- At some places the streams originating in the Western Ghats descend along steep slopes and make waterfalls.
- The Saravati while descending over such a steep slope makes an impressive waterfall known as Gersoppa (Jog) Falls which is 271 m high.
- Marine topography is quite marked on the coast.
- To the east of this plain lies the highest waterfall of India, called Jog or Gersoppa which falls across the Saravati River. The height of the fall is 275 meters.
- 1. f. The Kerala or Malabar Coastal Plain
- The southern part of Western Coastal Plain is known as the Kerala Plain or the Malabar Plain. (Fig: 1.61)
- The Malabar Coast lies between Mangalore and Kanyakumari.
- This is much wider than the Karnataka Coastal plain.
- It is a low lying plain
- It is about 550 km long and 20-100 km wide.
- The maximum extension of the Malabar Coast is found in the valleys of the Beypore, the Ponnani (draining through Palghat), and the Periyar and Pamba Achankovil rivers.
- This coast is characterised by sand dunes.
- Along the coast, there are numerous shallow lagoons and backwaters.
- These lagoons are linked together to facilitate navigation through small country boats.
- **Vembanad,** near Kochi is 75 km long and 5-10 km wide. It being the largest, gives rise to a 55 km long spit {Marine Landforms}. Asthamudi Kayal, near Quilon is another important lagoon of the Malabar Coast.

- The coast shows evidence of emergence.
- The backwaters, locally known as kayals are the shallow lagoons or inlets of the sea, lying parallel to the coastline.
- \* Regional Names of The Western Coastal Plains of India
- Konkan coast- Maharashtra coast and Goa coast;
- Malabar Coast- Kerala and Karnataka coast coastlines of Emergence and Submergence
- 2. The Eastern Coastal Plains
- Lies between the Eastern Ghats and the Bay of Bengal.
- It extends from the mouth of the Subarnarekha River along the West-Bengal Odisha border to Cape Comorin or Kanyakumari in the south, for nearly 1500 km.
- It stretches along the coasts of Orissa, Andhra Pradesh and Tamil Nadu.
- It is **marked by deltas of rivers** like the Mahanadi, the Godavari, the Krishna and the Cauvery.
- There are some of the **important lagoons** of India along the Eastern coast. **Chilka Lake** in the south-west of the Mahanadi delta is the biggest lake (65 km x 8 km) in the country.
- The Kulleru lake lies between the deltas of Godavari and Krishna
- **The Pulicat Lake** (lagoon) lies further south on the border of Andhra Pradesh and Tamil Nadu is another important geographical feature of east coast.
- The East coastal plains consist mainly of Recent and Tertiary alluvial deposits.
- A major part of the plains is **formed as a result of the alluvial fillings of the littoral zone** (relating to or on the shore of the sea or a lake) by the rivers Mahanadi, Godavari, Krishna and Cauvery comprising some of the largest deltas of the world.
- In contrast to the West Coastal Plains, these are **extensive** plains with an average width of 120 km.
- These are **gentle, monotonous plains** rising gently westward to the foot of the Eastern Ghats.
- The monotony of the topography is broken by the **presence of numerous hills.**
- This coastal plain has a straight shoreline with well defined beaches of sand and shingles.
- The most famous is the Marina Beach in Chennai.

- All along the coast, there are **several sandbars** generally in front of the river mouths.
- The east coast of India, especially its south-eastern part (Tamil Nadu coast), **appears to be a coast of emergence**.
- The Eastern Coastal Plains may be further sub-divided into two divisions:
- 1. North Circar Coast
- Northern part of the East coast.
- Extends from the mouth of river Subarnarekha to the Krishna Delta.

#### 2. Coromondal Coast

- Southern part of the East coast.
- Extends from the Krishna Delta to Cape Comorin.
- The Tamil Nadu coast and parts of Andhra coast together are known as Coromandal Coast.
- Coramandal coast (Tamil Nadu)is Coastline of emergence
- ✤ According to states the Eastern Coastal Plain is subdivided from north to south into the following division:
- 1. Orissa Coastal Plain
- It **extends** from the mouth of the Subarnarekha in the north to Rushikulya River in the south.
- In Orissa (Odisha) it is known as Utkal coast.
- It includes the Mahanadi delta.
- The most prominent physiographic feature of this plain is the **Chilka Lake**.
- It is the **biggest lake in the country** and its area varies between 780 sq km in winter to 1,144 sq km in the monsoon months.
- South of Chilka Lake, **low hills dot the plain**.
- 2. Andhra Coastal Plain
- It **extends** from the southern limit of the Utkal plain, and stretches along the Andhra coast i.e. from the mouth of the Rushikulya River in the north to the Lake Pulicot in the south.
- The most **significant feature** of this plain is the delta formation by the rivers Godavari and Krishna.
- The **two deltas have merged** with each other and formed a single physiographic unit.

- This part of the plain has a **straight coast and badly lacks good harbours** with the exception of Vishakhapatnam and Machilipatnam.
- 3. Tamil Nadu Coastal Plain
- In the south of the Andhra Coastal plain is the Tamil Nadu coast.
- The Tamil Nadu Plain **stretches for 675 km** from Pulicat Lake in the north to Kanyakumari in the south along the coast of Tamil Nadu.
- Its average width is 100 km.
- The most important feature of this plain is the Cauvery delta where the plain is 130 km wide.
- The **fertile soil and large scale irrigation** facilities have made the Cauvery delta the **granary of South India**.
- The sand dunes along the Tamil Coast are called '**Theris**' by the locals.
- Significance of the Coastal Plains
- Large parts of the 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.
- The entire length of the coast is dotted with big and small ports which help in carrying out trade.
- The sedimentary rocks of these plains are said to contain large deposits of mineral oil.
- The sands of Kerala coast have large quantity of Monazite which is used for nuclear power.
- Fishing is an important occupation of the people living in the coastal areas.
- Low lying areas of Gujarat are famous for producing salt.
- Kerala backwaters are important tourist destinations.
- Goa provides good beaches. This is also an important tourist destination.

# ✤ The differences and comparison between Eastern and Western Coastal Plains are discussed below:

1. The Eastern Coastal plain lies along the east coast of India and is washed by the Bay of Bengal whereas, the Western Coastal Plain lies along the west coast of India and is washed by The Arabian Sea. 2. The East Coast plain runs smoothly from the north to the south with a broad plain and level surface while the West Coast plain also runs from the north to the south and it is in some places intersected by the mountain ridges.

3. Eastern Coastal Plain is broader than the West Coast plain.

4. The large rivers make wide deltas on the Eastern Coastal Plains but the short swift rivers do not make any deltas on the West Coast.

5. The Eastern Coast is sandy with alluvium and slopes gently towards the sea, sand dunes and marshy lands and lagoons are also found. But the Western Coast is relatively rocky with sand and sand dunes. It slopes abruptly down to the sea. There is no lagoon on the northern part. It has many estuaries on the Konkon Coast. But the southern part especially the Malabar Coast has the beautiful scene of back-water country with a series of lagoons.

6. The Eastern Coast is smooth and unfit for making ports. So, very few ports are developed there whereas the Western Coast is broken and indented and suitable for ports.

7. The Western Coastal plain receives heavy rainfall while the eastern Coastal plain receives comparatively low rainfall.

8. The deltas on the East Coast Plain are formed by fine alluvial soil and are fertile and agriculturally prosperous while the West Coast Plain is washed by the Arabian Sea. The West Coast Plain, formed by coarse grained soil is infertile and agriculturally not prosperous except in the Malabar Coast.

# **1.12. DRAINAGE PATTERNS**

According to the configuration of the channels, drainage systems can fall into one of several categories known as drainage patterns. Drainage patterns depend on the topography and geology of the land.

- There are numerous patterns that drainage systems follow:
- 1. Accordant drainage patterns and
- 2. Discordant drainage patterns
- 1. Accordant drainage patterns

A drainage system is described as accordant if its pattern correlates to the structure and relief of the landscape over which it flows.

There are the following **most common drainage patterns** that we come across on the land surface of the earth.

(i) Dendritic Pattern (iv) Annular Pattern (vii) Deranged Pattern

(ii) Trellis Pattern (v) Radial Pattern (viii) Centripetal Pattern

(iii) Barbed Pattern (vi) a. Rectangular Pattern b. Angular Drainage Pattern (ix) Parallel Drainage

## 2. Discordant drainage patterns

A drainage pattern is described as discordant if it does not correlate to the topology and geology of the area. **Discordant drainage patterns are classified into two main types:** 

(x) Antecedent and

(xi) Superimposed

• The different types of Accordant and Discordant drainage patterns are as follows:

# (i) Dendritic Pattern:

A **dendritic drainage pattern** resembles the pattern made by the branches of a tree or the veins of a leaf or the branching pattern of tree roots. In this pattern tributaries join the larger streams at acute angles (less than 90 degrees). Most of the **rivers** of the **Indo-Gangetic** Plains are of dendritic type.

# (ii) Trellis Pattern

**Trellis Drainage Pattern** develops if the rocks are made up of alternate hard and soft layers. Here the tributaries follow the pattern of the rock structure and enter the main river at an approximately 90 degree angle resulting into a trellis-like appearance of the drainage system. Trellis drainage is characteristic of folded mountains, such as the Appalachian Mountains in North America. In India, The old folded mountains of the **Singhbhum (Chotanagpur Plateau) have a drainage of trellis pattern.**
#### (iii) Barbed Pattern:

**The barbed pattern,** generally developed due to river capture, is formed when the tributary flow in opposite direction to their master streams. The **Arun River** (Nepal), a tributary of the **Kosi** is an example of barbed drainage pattern.

#### (iv)Annular Pattern

In an **annular drainage** pattern the subsequent streams follow the curving or arcuate courses before joining the consequent stream. In this pattern the streams follow a roughly circular or concentric path along a belt of weak rock, resembling a ring- like pattern. Some examples of this are however found in Pithoragarh (Uttarakhand), **Nilgiri Hills** in Tamil Nadu and Kerala.

#### (v) Radial Pattern

In a radial drainage system, the streams radiate outwards from a central high point or dome. Usually excellent radial drainage pattern is displayed on conically shaped features as Volcanoes. In India Radial drainage patterns are also found in the **Girnar Hills** (Kathiawar, Gujarat), and Mikir Hills of Assam.

#### (vi) a. Angular and b. Rectangular Drainage Pattern

Where rocks are consistently hard but have been fractured by faulting or other processes **Angular and Rectangular Drainage Pattern** forms.

#### (vi) a. Angular drainage patterns

Angular drainage patterns form where bedrock joints and faults intersect at more acute angles than rectangular drainage patterns. Angles are both more and less than 90 degrees.

#### (vi) b. Rectangular Pattern

Rectangular drainage pattern develops on rocks that have uniform resistance to erosion, but two directions of joining at approximately right angles. A typical example of this drainage pattern is found is the Vindhyan Mountains of India

#### (vii) Deranged Pattern.

**Deranged or contorted drainage patterns** develop from the disruption of a pre-existing drainage pattern. It occurs in drainage basins where there is no coherent pattern to the rivers and lakes. This type of drainage is found in the glaciated valleys of Karakoram

#### (viii) <u>Centripetal Pattern</u>

In **centripetal drainage** pattern, streams flow toward a central depression. Sinkholes, craters and other basin-like depressions display this type of drainage pattern. This pattern is typical in the western and south-western portions of the United States where basins exhibit interior drainage.

#### (x) Parallel drainage pattern

Parallel drainage pattern forms on uniformly sloping surfaces where all the streams flow parallel to each other in the same direction following the slope of the region. The small and swift rivers originating in the Western Ghats and discharging their water into the Arabian Sea are example of parallel drainage pattern in India.

#### (xii) Antecedent drainage

In antecedent drainage, a river's vertical incision ability matches that of land uplift due to tectonic forces. The Himalayan Rivers are great examples of antecedent origin.

#### (xiii) Superimposed drainage

The Superimposed drainage is a natural drainage system developed by erosion and has little relation to the area's geological structure. It is also known as discordant drainage as it shows discordance with the underlying rock structure. In India the Damodar, the Subarnarekha, the Chambal are some examples of superimposed drainage.

# **1.13. DRAINAGE BASIN OF INDIA**

A river along with its tributaries forms a river system. The drainage systems in India are chiefly controlled by the broad relief features of the subcontinent.

The Indian drainage is broadly divided into

- (a) Bay of Bengal Drainage
- (b) Arabian Sea drainage.

The Indian rivers are also divided into two major groups:

- the Himalayan Rivers and
- the Peninsular Rivers
- There is also an **Inland drainage** present in Indian drainage system.
- The Himalayan Rivers
- Characteristics of Himalayan rivers are as follows:
- Most of the Himalayan rivers are perennial.
- These rivers are rain fed as well as snow fed.
- Major rivers, The Indus, the Brahmaputra have cut through the mountains making gorges.
- The Himalayan rivers have long courses from their source to the sea.
- They perform intensive erosional activity in their upper courses and carry huge loads of silt and sand.
- In the middle and the lower courses, these rivers form meanders, oxbow lakes, and many other depositional features in their floodplains.
- They also form deltas.
- In India there are three major Himalayan River systems :
- 1) the Indus,
- 2) the Ganga and
- 3) the Brahmaputra river systems.
- 1. The Indus River System:
- The river Indus, the westernmost of the Himalayan rivers which originates in Tibet, in the springs of Sengee Khabab about 100 km. north of Lake Mansarowar, at an altitude of 5,180 metres.
- Flowing westwards from its origin, it enters the Indian Territory in the Ladakh district of Jammu & Kashmir where it receives Himalayan tributaries such as the Gartang, Zaskar, Dras, Shyok, Shigar, Nubra, Gilgit and Huza.
- It forms a very picturesque gorge (3000m deep near Bunji) in this area.
- Famous city Leh also lies on banks of the Indus.

- After flowing through Baltistan and Gilgit, the Indus emerges from the mountains at Attock. Sutlej, Beas, Ravi, Chenab and Jhelum join together and enter the Indus near Mithankot in Pakistan.
- On entering Pakistan, it takes southward turn and runs hundreds of kilometres to meet Arabian Sea east of Karachi.
- The river Indus, one of the longest rivers of the world has a total length of about 2900 km.
- 709 km long in India.
- About a third of Indus basin is located in India in the states of Jammu & Kashmir, Himachal Pradesh and Punjab.
- The rest of the portion is in Pakistan.

#### 2. The Ganga River System

#### I. River Ganga

- The main headwater of Ganga is called Bhagirathi which takes its rise in the Gangotri Glacier. The Gomukh, an ice cave is also taken to be its source.
- Sweeping westward for 35 km the Bhagirathi turns south and cut through the great Himalayas in a deep valley.
- Bhagirathi is called the Ganga when it is joined by Alaknanda at Devprayag in Uttarakhand.
- At Rudra Prayag Mandakini, originating from Gourikund, meets the Alaknanda.
- Flowing south for 70 km Ganga cuts through two ranges , the Nag Tibba and the Siwalik and descends on to the plains at Hardwar.
- In the plains river Ganga flows towards the south east upto Mirzapur and then east wards in Bihar plains.
- Near the Rajmahal Hills it turns to the south east and enters West-Bengal.
- In West Bengal the river Ganga flow east ward and near Dhulian it is divided into two distributaries, Padma and Bhagirathi.
- Padma enters Bangladesh.

- When Padma is joined by the Brahmaputra it is known as Meghna, further downstream.
- The other one, the Bhagirathi, flows south ward and is known as Hugli from Chinsura to the mouth of the Bay of Bengal forming an estuary.
- The total length of Ganga is 2510 km.
- Finally, the Ganga and the Brahmaputra flow into the Bay of Bengal forming the Sunderban Delta.
- Chambal, Betwa and Son, the major tributaries which come from the peninsular uplands, rise from semi arid areas, have shorter courses and do not carry much water in them.

**Tributaries of Ganga:** Yamuna, Ghraghara, Gandak and Kosi are the major tributaries of Ganga.

Distributaries of Ganga: Jalangi, Mathabhanaga, Ichhamati

#### II. River Yamuna

- **Yamuna** originates from the Yamunotri Glacier in the Himalayas.
- Traversing Lesser Himalayas for 75 km. comes down to the plain at Paonta.
- On the plains it flows towards south upto Agra and further down towards the south east till it meets Ganga at Allahabad.
- It flows parallel to the Ganga as a right bank tributary.
- Yamuna is about 1375 km long.
- Yamuna receives a number of tributaries from the central Highlands: They are, the Chambal, the Betwa, the Sindh, the Ken.

#### III. River Gharghara

• River Gharghara rises in Nepal. It joins Ganga near Chapra.

#### **IV. River Gandak**

• Rises in the Great Himalayas, joins the left bank of Ganga at Sonpur.

#### V. River Kosi

. River Kosi rises in the Tibet Plateau. Joins the left bank of the Ganga at Kargola.

# VI. River Ramganga

• Originates from the Kumaun Himalayas. Joins Ganga as its left bank tributary at Kanauj.

# 3. The Brahmaputra River System:

- The Brahmaputra River is about 2580 km long. Most of the course of the Brahmaputra lies outside India. In India it is about 885 km long.
- The Brahmaputra rises in the Chemayungdung glacier (4900m) located 90 km south east of Rakshas Tal and Mansarowar lake in Tibet.
- It flows eastwards parallel to the Himalayas.
- In Tibet it is known as Tsangpo.
- After reaching Namcha Barwa peak, (7757 mts high peak in Tibet) it takes a 'U-turn' to enter into India in Arunachal Pradesh through a deep gorge.
- It is known as Dihang in this region.
- The Dihang enters Assam near Sadiya
- It is then joined by Dibang, Lohit, Kenula and many other tributaries' and the combined flow forms the Brahmaputra in Assam. At Dhubri the Brahmaputra turns south ward turn and enters Bangladesh as Jamuna.
- It then finally drains into the Bay of Bengal.
- Important Tributaries are : Dibang, Luhit, Subansiri, Torsha , Tista, Dhansiri, Kopili etc.
- There are innumerable river islands. Majuli (929 sq km.) the largest river island of the world has been formed on the bed of Brahmaputra.
- Brahmaputra shifts its course frequently.

# • The Peninsular Rivers:

- <u>Characteristics of the rivers of Peninsular India</u>
- Most of the Peninsular Rivers are seasonal because they depend on rainfall for water.

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

✤ 1.13.1. The Peninsular River system consists of Narmada, Tapti, Mahanadi, Godavari, Krishna and Cauvery rivers. According to the direction of flow, these rivers can be grouped as the (i) east flowing rivers and (ii) west flowing rivers. Among them Mahanadi, Godavari, Krishna and Cauvery are east flowing rivers. Narmada and Tapti (Tapti) are the only long rivers which are west flowing.

# Rivers of the Peninsular India are as follows:

# Major West flowing rivers:

- I. The Narmada Basin:
- The Narmada rises in a tank at an elevation of 1057 m in the Amarkantak peak of Mahakal range in Madhya Pradesh. It drains into the Arabian Sea through the Gulf of Khambat near Bharuch in Gujarat, forming an estuary at its mouth.
- It flows towards the west through a rift valley in faulting zone of Vidhyan and Satpura hills.
- It is 1312 km. long.
- The Narmada basin covers parts of Madhya Pradesh and Gujarat.
- All the tributaries of the Narmada are very short.
- Most of the tributaries join the Narmada at right angles. .

- It is the largest among all west flowing rivers of the peninsula and after Godavari and Krishna, is third longest river that flows entirely in India.
- It has formed the famous Dhauladhar waterfalls on the Bheraghat marbles near Jabalpur.

# II. The Tapti Basin

- The **Tapti** (724 km) rises from a spring near Multai (1922m) on the Satpura ranges, in Betul district of Madhya Pradesh.
- The basin of Tapti covers parts of Madhya Pradesh, Gujarat and Maharashtra.
- It flows through a rift valley lying between the Satpura range and the Ajanta range.
- It crosses the Western Ghats through a deep and narrow valley.
- River Tapti empties into the Gulf of Khambat, just south of river Narmada, near Surat in Gujarat.
- It has formed an estuary in the Gulf of Khambat.
- Tapti runs parallel to the river Narmada and is the second largest west flowing river of Indian peninsula.
- Ukai dam in Gujarat is on river Tapti.
- River Purna is its major tributary.
- ✤ Major east flowing rivers

#### III. The Godavari Basin:

- Godavari is 1465 km long and is the longest perennial river of the peninsular plateau.
- The river Godavari rises in the slopes of the Western Ghats in Trimbakeswar in Nasik district of Maharashtra.
- After flowing over the Maharashtra plateau and the Telengana plateau it crosses the Eastern Ghats through a picturesque gorge, Papi Hill Gorge, and emerges at Polavaram into the Coastal Plains.
- Below Rajahmundry it splits into distributaries namely, Gautami Godavari, Vasistha Godavari and Vainataya.
- These rivers form the deltas at the mouth.
- It drains into the Bay of Bengal.

- Its drainage basin is also the largest among the peninsular river basins.
- Purna, Wardha, Pranhita, Manjra, Waiganga and Penganga are the main tributaries of Godavari.
- It is also known as the 'Dakshin Ganga'.

#### IV. The Mahanadi Basin:

- This river originates in the Sihawa Range in the highlands of Chhattisgarh and drains into the Bay of Bengal.
- The upper Mahanadi flows through the Chhattisgarh Plain
- Flowing north ward it receives the Seonath on its right bank.
- Below Seorinarayan it flows east wards and turns south wards a little below Hirakund Dam.
- Near Sonapur it turns again east wards.
- After crossing the Eastern Ghats through a gorgy it divides itself distributaries at Cuttack.
- Seonath, Brahmani, Baitarani are the important **tributaries** of the river Mahanadi.
- The combined flow of the Mahanadi, Baitarani, and Brahmani discharged through a common mouth and formed deltas after Cuttack.
- It is about 860 km long
- The most important distributary at the delta is Katajuri.
- The Mahanadi basin covers Maharashtra, Chhattisgarh, Jharkhand and Orissa.

#### V. The Krishna Basin:

- The Krishna river **originates** from a spring near Mahabaleshwar in eastern side of Western Ghats in Maharashtra.
- It **flows** south and south east wards through Karnataka and Andhra Pradesh before it **drains** into the Bay of Bengal.
- It is about **1400 km** long.
- Major **tributaries** are Bhima, Tungabhadra, Koyana, Ghatprabha, and Musi.
- Notable **distributaries** are Vamsdhara and Nagawati in the delta region.

• Krishna is the **second largest east flowing** river of peninsular India. Its **drainage basin** is shared by the States of Maharashtra, Karnataka and Andhra Pradesh.

#### VI. The Kaveri (Cauvery) Basin:

- The Kaveri originates in the Brahmagiri range of the Western Ghats in the Coorg Districts of Karnataka and drains into the Bay of Bengal in south of Cuddalore, in Tamil Nadu.
- It flows east wards crossing the Ghats.
- Total length of the river is about 760 km.
- Shimsha and Amravati are left bank tributaries, Bhavani, Hemavati, Lakshman Tirtha and Kabini are other tributaries.
- The Kaveri splits into two branches in the west of Tiruchirapalli, the northern branch known as Coleroon while the southern branch known as Kaveri.
- They again join together forming between them the island of Srirangam.
- Thereafter, Coleroon take a north eastern direction and Kaveri takes a southern direction.
- Kaveri splits into several branches like Vena, Keclanurtiyar and Asasalai forming the deltas at its mouth in the Bay of Bengal.
- The Kavery basin covers Karnataka, Kerala and Tamil Nadu.
- It has several waterfalls and rapids in its course.

 Other East flowing rivers are : Pennar, Bhaigai, Tamraparni

Other **West flowing rivers** are: Sabarmati, Saravati, Ullhas, Ntrabati, Sabitri etc.

River Saravati has formed the highest waterfalls in India i.e. Jog or Gersoppa or Mahatma Gandhi waterfalls which is 275 m high

#### Differences between the Himalayan and the Peninsular India

1. The Himalayan Rivers are perennial, i.e. they flow throughout the year. These rivers are both snow fed and rain fed such as, the Ganga, the Yamuna, the Brahmaputra and the rivers of Punjab whereas the peninsular rivers are seasonal. They do not flow

throughout the year. These are only rain fed. Examples are Narmada, Tapti, Godavari, Krishna etc.

2. The basins of the Himalayan Rivers are generally large compared to the peninsular rivers, e.g. the Ganga basin, the Indus basin. The basins of the Peninsular rivers are often small, e.g. the Narmada basin, the Tapti basin etc.

3. The Himalayan Rivers are often long because their sources are far away from the ocean. The Peninsular rivers are comparatively smaller.

4. In case of the Himalayan rivers less number of rivers flow into the ocean as most of them are either the main rivers or are the tributaries of a large river. On the contrary most of the Peninsular Rivers flow into the ocean because of high peninsular slope.

5. The Himalayan Rivers form deep valleys and gorges in their source areas. On the other hand, the peninsular river valleys are often shallow.

6. The Himalayan Rivers are navigable. But the Peninsular Rivers are not navigable. They are only navigable in the delta regions.

7. The Himalayan rivers form meanders because they flow through plains where the land is friable, i.e. soft.

The Peninsular Rivers flow through hard rocky areas and have straight and linear courses. For example Narmada and Tapti develop linear drainage system because they flow through rift valleys.

8. The Himalayan Rivers have formed large deltas at their mouths. But the Peninsular Rivers often form estuaries or small deltas at their mouths.

9. Himalayan rivers are long and young while the Peninsular Rivers are short and ancient.

# 1.14. SEASONS OF INDIA

On the basis of the weather phenomenon, the Indian meteorological department has conveniently divided the year into **four different types of seasons** which rotate in a cycle. They are as follows:

- 1. The Hot Weather Season—March to May.
- 2. The South-West Monsoon Season—June to September.

# 3. The Retreating South-West Monsoon Season—October to November.

#### 4. The Cold Weather Season—mid-December to February.

There are regional variations in the length of period of these seasons in India. These differences are significant as we move from the south towards the north.

The Northern India experiences a distinct winter season as well as a distinct hot weather season.

#### 1. The Hot Weather Season (March to May)

#### Characteristics:

- The hot weather season begins in March and continues till the end of May.
- During this period there is a rapid increase in temperature.

#### Temperature:

- May is the hottest month of the season, and temperature often rises to about 40°C.
- The highest temperature is recorded in the north-west and west.
- Condition of low pressure develops over north-west India.
- This area of low pressure is also called the monsoon trough.
- But at this period it is too weak to start the monsoon.
- Around this trough a local circulation of air sets in.
- As a result local Storms of violent type occur during April and May.
- These are thunderstorms, accompanied with strong winds are heavy rainfall.
- Hot and Dry wind called **Loo** sweeps over the Indo-Ganga Plain which is known as **Andhi** in Rajasthan.
- Plateaus, hills and mountains are comparatively cool owing to their elevation.

• The temperature is bearable in the coastal plain owing to the nearness to the sea.

# <u>Rainfall</u>

• In summer thunder showers occur which are locally known as **Kalbaishaki** in West Bengal, **Mango Showers** in South India, **Bardaichhila** in Assam.

# 2. The South-West Monsoon Season—June to September.

# Characteristics:

- With the advent of summer, the heat accumulates and the temperature rises steadily throughout India.
- Therefore an intense low pressure cell develops in Rajasthan.
- The low pressure which existed over Northern Plain is further intensified. It is now strong enough to attract the moisture bearing winds from the Indian Ocean.
- It pulls the south east trade wind which on crossing the equator becomes south west monsoon winds (according to Ferrell's Law ) and arrives all of a sudden over Cape of Comorin.
- This is known a "Burst of Monsoon".
- The bulk of rainfall is received during this season in almost every part of India except Tamil Nadu.
- It is then divided into two branches

# 1. The Arabian Sea Current and

# 2. The Bay of Bengal Current.

• The Arabian Sea Current gives orographic rain to the western coastal plains of India while the Deccan Plateau being the rain shadow area of the Western Ghats, remains dry. The northern section of the Aravian Sea branch does not give any rain in Gujarat as it blows parallel to the Aravalli Range.

• **The Bay of Bengal Current** gives heavy orographic rain to the southern slopes of the Himalayas and the Meghalaya Plateau. Mawsynram receives the highest rainfall (about 1250 cm) in the world. Shillong lies in the rain shadow area of the Meghalaya plateau. It gives rain in Assam, West Bengal and moves westwards and rainfall decreases gradually in Bihar, Uttar Pradesh and Punjab.

#### Temperature

The sky remains overcast so temperature varies between 20°C.
 - 30°C.

#### Rainfall

- 80% of rainfall occurs in this season in India.
- Rainfall is mainly orographic in nature.
- Maximum rainfall occurs in the western coastal plains and in the north east.
- Except the desert in the north west the rest of India receives rainfall varying between 60-200 cm.



Fig: India temperature (Jul)

# 3. The Retreating South-West Monsoon Season—October to November.

### Characteristics:

- On 23<sup>rd</sup> September the sun lies over the equator and moves towards the south. So, the temperature starts to decrease in India and the low pressure cells disappears.
- By the end of September or early October, the intensity of low pressure and rainfall becomes much less.
- Conditions which prevailed over north-western part and central part of India begin to decrease.
- Consequently, the South-West monsoon winds begin to retreat. They leave Punjab plain by mid-September, the Ganga delta by the late October and the south by early November.
- This act of the monsoon winds in known as Retreat of Monsoon.
- During this season, as the south-west monsoon winds retreat, the north-east monsoon winds approach and sometimes they collide, resulting in the formation of Cyclones, particularly on the coastal strip of the Bay of Bengal.
- In the West Bengal these Cyclones are known as 'Aswiner Jhar' or the storms of the autumn. They give some rains.

#### Temperature

• Is moderate and the sky remains clear.

Fig: Winter Monsoon

#### 4. The Cold Weather Season—mid-December to February.

#### **Characteristics**:

- Starting in early December it continues till February.
- On 22<sup>nd</sup> December the sun lies over the Tropic of Capricorn.
- As a result of the southerly movement of the sun, during this season, the sun's rays do not fall vertically in any part of the country.
- The temperature decreases from south to north.
- The decrease in temperature in north India forms high pressure.
- The wind therefore blows from the north-east as off-shore winds.

- The days are warm and nights are cold. Hence diurnal range of temperature is high.
- The snowfall is common in some parts of the Himalayan range.
- The high pressure area develops over the plains in the north-¬west regions.
- The winds blow from high pressure area to the low pressure area over the south. These winds are called winter monsoons.
- They blow in north-east direction.
- Generally a fair weather prevails. It is characterized by clear skies, high pressure, low humidity and rain-less days.
- This fine weather is occasionally disturbed by the cyclonic depressions visiting from the Mediterranean Sea. They bring rain in areas of Jammu & Kashmir, Punjab, Himachal Pradesh, Haryana, Rajasthan and U.P. Sometimes, they invade up to West Bengal.

#### Temperature

• The mean January day temperature in Chennai (South India)is about 24°C while in the northern plain it is about 8° to 15°C.



Fig: India Temperature (Jan)

#### Rainfall

- The north-east monsoon wind is very dry.
- The amount of rainfall decreases towards the east.
- They also cause snowfall in North-Western Himalayan regions such as Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh.
- As these west-winds come from the west, they are popularly known as 'Western Disturbances'.
- The precipitation offered by these winds, is of great importance for Rabi Crops, especially wheat.
- The average precipitation varies from 20 mm. to 50 mm.
- Winter rainfalls also occur along the coastal strip of Tamil Nadu.
- The north-east monsoon winds absorb moisture while blowing over the Bay of Bengal before crossing the coast.
- These winds strike against the Eastern Ghats and cause rainfall on Coromandel Coast.

#### Influence of Monsoon on the rainfall distribution of India

India is a land of Tropical Monsoon type climate. The most dominating factor of the Indian climate is the monsoon winds and hence it is often called the monsoon climate. The complete reversal of the monsoon wind brings about a sudden change in the seasons of India.

Besides the monsoons, the Indian climate is also substantially influenced by two more factors.

#### a. the Himalayas

#### b. the Indian Ocean

The Himalayas, that contribute a continental nature to the climate is recognised by land winds, dry air, large diurnal range and scanty rainfall and the **Indian Ocean** that contributes a tropical character to the Indian climate characterised by uniformity of temperature throughout the year, short diurnal range, damp air, and frequent rainfall.

#### **Classical Theory or Thermal Concept of Indian Monsoons:**

According to this theory, when the sun makes an apparent northward movement there is a differential heating of land and sea. This is considered as the main cause of the Indian monsoonal regime.

The two factors that are mainly responsible for this very strong development of monsoons are as follows:

- (i) Vast size of the Indian subcontinent and adjacent seas;
- (ii) Presence of the Himalayas

Very high and extensive mountain systems of the Himalayas in the north have a great meteorological significance. It extends in an east-west direction, thus posing a formidable physical barrier between tropical and polar air masses. Bordering Indian subcontinent on the three sides, they work both as a break and motor. During the winter season, they prevent the penetration of the cold polar air masses from Siberia into the subcontinent, while in summer, the Himalayas do not allow the equatorial maritime air masses to cross the Himalayas and force them to curve round the north-west. The Himalayas obstruct the moist south-west monsoon winds and give heavy rainfall to India. So, in can be said that the mighty Himalayas produce hydro-dynamic effects that determine the type of precipitation in India.

#### The Thermal Concept:

According to the thermal concept, the sun starts its apparent northward shift during the period following the Spring Equinox (March 23). As a result, the areas lying north of the equator i.e. tropics and sub-tropics, get a progressive high incidence of solar radiation. Intense heating of the vast northern plains and the adjoining highlands on the Indian subcontinent is the effect of this phenomenon.

Owing to the overhead position of the sun over the Tropic of Cancer and hence excessive heating, a massive low pressure trough is formed extending from the Punjab plains in the north-west India while high pressure develops on the Indian Ocean. This **low pressure zone** attracts wind regimes from the adjoining areas, from short distances in the beginning. But as the level of solar incidence reaches its peak during May-June, the pressure gradient between this low pressure trough and the adjoining seas is so great that it attracts winds from as far as the south of the equator.

Being attracted by this low pressure centre over the Indian subcontinent, South-east trade winds, prevalent south of the equator, cross the equator and is deflected to their right as **southwest monsoon winds,** following Farrel's law. So, the originally south-east trade winds blow towards the north-east as south-west monsoons. By end of May the south-west monsoons "burst" on the Kerala coast with storm and rain called the "**Monsoon Burst**".

At this juncture, the Inter- Tropical Convergence Zone (ITCZ) also shifts northwards. The ITCZ is the hypothetical line where the north-east trade winds from the northern hemisphere and the south-east trades from the southern hemisphere meet. The southwest wands now approaching the Indian peninsula have to travel a long distance over the Indian Ocean.

These winds, being warm, pick up sufficient amount of moisture from Indian Ocean, during their journey. By the time they reach India they are oversaturated. Due to the peninsular shape of India, the south-west monsoons get divided into two branches as the Arabian Sea branch and the Bay of Bengal branch. There moisture-laden winds cause heavy rainfall on the windward sides.

The two main branches, the Arabian Sea branch and the Bay of Bengal branch, of the monsoon winds originally set out to fill the intense low pressure void created in the north-west of the subcontinent. But they follow different courses and the two branches meet at the Chhotanagpur Plateau. As the Arabian Sea is bigger in size and most of the Arabian Sea branch falls over India, this branch is more powerful of the two. On the other hand, most of the Bay of Bengal branch goes to Myanmar, Malaysia and Thailand.

#### The Arabian Sea Branch:

The Arabian Sea Branch of the south-west monsoons strikes the highlands of the Western Ghats at almost right angles. The windward slopes of the Western Ghats receive heavy orogenic precipitation exceeding 300cm. Although the western currents of the monsoon penetrate further into the Indian mainland the intensity of rainfall goes on decreasing on the leeward side. As a result, Deccan Plateau receives less rainfall (60 cm), forms a rain shadow region. After crossing the Western Ghats, the rain- bearing air currents descend the eastern slopes where they get warmed up adiabatically. This results in a pronounced rain-shadow area. The higher the mountains, the larger are the rain-shadow effect.

Another Arabian Sea branch gives little or no rainfall to Kachchh and Western Rajasthan because there is no mountain barrier to tap the advancing winds and the Aravalli Range lies parallel to the direction of winds. The monsoon currents heading towards Rajasthan are rather shallow and are superimposed by stable anti-cyclonic air.

The hot and dry continental air masses from western Pakistan (Baluchistan) are drawn towards the thermal low developed in this region. These air masses check the ascent of air and absorb its moisture. These conditions are unfavourable for precipitation in Kachchh and western Rajasthan where desert conditions prevail.

Some of the currents from the Arabian Sea branch which manage to proceed towards Chhotanagpur plateau through the Narmada and Tapti gaps ultimately unite with the Bay of Bengal branch.

A few air currents from the main Arabian Sea branch, diverted northward towards Kachchh and the Thar Desert, continue upto Kashmir without causing rain anywhere on their way.

#### **Bay of Bengal Branch:**

A northern current of the Bay of Bengal Branch, of south west monsoon wind, blows over the Bay of Bengal and picks up moisture. Going over the Ganga-Brahmaputra Delta it strikes the Khasi hills in Meghalaya and causes very heavy rains. Mawsynram (near Cherrapunji), situated on the southern slopes (windward side) of Khasi hills, receives the highest rainfall in the world (1392 cm). The wind blows further north and is obstructed by the eastern Himalayas. These winds are deflected towards the west by the Himalayas. It takes a left turn at the eastern end of the low pressure trough i.e. the Bengal delta. From here, it blows in a south-east to north-west direction along the orientation of the Himalayas. This current causes rainfall over the northern plains. The monsoon rainfall over the northern plains is assisted by west-moving monsoon or cyclonic depressions called 'westerly disturbances'. The Bay of Bengal Branch monsoon winds become moisture less when it reaches the Thar Desert. The winds get obstruction by the Aravalli range and cause very little rainfall.

The intensity of rainfall decreases from east to west and from north to south in the northern plains. The decrease in the rainfall intensity towards west is attributed to the increasing distance from the source of the moisture while the decrease from north to south, is due to increasing distance from the mountains which are responsible for lifting the moisture-laden winds and causing orogenic rainfall in the plains, especially in the foothills.

#### **Retreating South West monsoon or North-East Monsoons:**

During October to November the South-West monsoon begins to retreat as retreating monsoon winds from the north east to the south west direction.

Towards the end of September, the low pressure centre in the north-west begins to disintegrate and eventually shifts to the equatorial region. The cyclonic conditions are replaced by anticyclonic ones. As a result, winds start blowing away from the northern region. Similar anti-cyclonic winds blow from the Tibetan highlands and beyond.

At this time the sun makes an apparent movement south of the equator. The ITCZ also moves equator ward. Now the winds that dominate the sub continental landscape are the ones which move from the north-east to the south-west.

These conditions continue from October till mid-December and are known as the retreating monsoons or the north-east monsoons. By December end, the monsoons have completely withdrawn from India. The retreat of the monsoons is markedly gradual in contrast to the 'sudden burst' of the south-west monsoons.

The retreating monsoons while crossing the Bay of Bengal pick up moisture on their way which is dropped over eastern or coastal Orissa, Tamil Nadu and parts of Karnataka during October-November. This is the main season of rains over these areas as they almost lie in the rain-shadow area of the south-west monsoons.

During October, easterly depressions occur at the head of Bay of Bengal which move southwards and in November get sucked into Orissa and Tamil Nadu coasts causing heavy rain, sometimes with destructive cyclonic winds in coastal and interior areas. The depressions weaken southwards and towards the interiors.

#### Winter Monsoons:

The stable, dry anti-cyclonic winds prevailing over the subcontinent after the retreat of the south-west monsoons are not capable of causing precipitation because they are free of moisture. Instead, these winds produce dry and fine weather. However, certain areas in the north and the north-western parts of India i.e. Punjab and Ganga plains get winter rainfall, from sources far away. These areas are invaded by shallow cyclonic disturbances moving from west to east which have their origin in the Mediterranean Sea. These are called "Westerly Disturbances' which travel across West Asia and Afghanistan before they reach India. These disturbances come with cloudiness and rising temperature in the front and cold wind in the rear. These disturbances cause up to 5 cm rainfall in Punjab and Kashmir and up to 2.5 cm over the Uttar Pradesh plains.

#### Rainfall Regions of India

**Rainfall Regions** mean an area receiving uniform distribution of rainfall. Based on the variation in rainfall distribution India may be divided into **five** Rainfall Regions. They are as follows:

a. **Very Heavy Rainfall Region** (annual rainfall more than 200 cm) – Western Slope of Western Ghats, Eastern Himalaya, Mizoram, North Bengal, Andaman Nicobar Islands belong to this region.

b. **Heavy Rainfall Region** (annual rainfall 100-200 cm) – The states of Bihar, Jharkhand, Uttarakhand, Chhattisgarh, north-eastern Uttar Pradesh, hills of Himachal Pradesh, Odisha and south Bengal belong to this region.

c. **Medium Rainfall Region** (annual rainfall 60-100 cm) – Punjab, Haryana, East Rajasthan, Karnataka, Tamilnadu and Maharashtra belong to this region.

d. **Low Rainfall Region** (annual rainfall 20-60 cm) – The rain shadow region of the Western Ghats, Western part of Punjab and Haryana and Central part of Rajasthan belong to this region.

e. **Very Low Rainfall Region** (annual rainfall below 20 cm) – Rajasthan Desert, Ladakh Plateau and Kashmir belong to this region.



Fig: India rainfall

# 1.15. SUMMARY:

India forms **a unique physiographic unit** distinguished by its diversity in south Asia, generally referred to as the Indian subcontinent. There are high mountain peaks in some areas while in others, lie the flat plains formed by rivers.

In this chapter you have learnt about **origin and the physiography of The Himalayas**, which stretch some 2,500 kilometres between India, Pakistan, China, and Nepal—having many mountain peaks over 8000 m, the runner-up being the mountain range in South America, whose tallest peak is just 6,962 meters tall.

**The Peninsular highlands,** rises to 100 metres (330 ft) in the north, and to more than 1 kilometre (0.62 mi) in the south, forming a raised triangle within the downward-pointing triangle of the Indian subcontinent's coastline. The north-western part of the

plateau is made up of lava flows or igneous rocks known as the **Deccan Traps**. The thick dark soil (called regur) found here is suitable for cotton cultivation.

On the other hand **Coastal plains are the waved platforms and the raised beaches above the water mark**. These are mainly the emerged floors from the seas that are adjacent to the land. The Plateau of Indian Peninsula is fringed by narrow coastal plains of varied width from north to south, known as the West-Coastal Plains on the west and the East Coastal Plains on the east.

In this chapter you have also learnt about the different kind drainage patterns. The Rivers that originate in Himalayas and beyond the Great Himalayas have also been learnt. These are the Indus, the Sutlej, the Brahmaputra Ganga, the Yamuna and their tributaries rivers. They flow through the Northern Plains. These rivers are useful for irrigation and navigation and the lowlands drained by them have fertile alluvial deposits.

The Peninsular Rivers originate in the Western Ghats. They have a large seasonal fluctuation in volume as they are solely fed from rainfall. These rivers flow in valleys with steep gradients. Major rivers of the Peninsula are Mahanadi, Godavari, Krishna, Cauvery, Narmada, and Tapti.

Apart from the River Basins and Drainage Patterns the different Types of Seasons prevailing in India and the Mechanism of Monsoon have been taken into consideration.

# **1.16. CHECK YOUR PROGRESS/ EXERCISE**

#### 1. True and false

- a) Major Geological Formations of the Peninsular India was about 3600 million years ago.
- b) The Himalayas consist of four parallel ranges from East to West.
- c) Highest peak of Zanskar is Leopargel.
- d) The height of the Mount Everest was measured 8,848 meters.
- e) Meghalaya Plateau is an extension of the Ganga Plain.
- f) Great Plains of India, also known as the Indus-Ganga-Brahmaputra plains, extends for a distance of about 13200 km and its width varies from 150 km to 300 km
- g) The vast Indo-gangetic plain has been formed as a result of

filling of a deep depression lying between the Coastal and the Himalayan region.

- h) The Great Plains of India are actually alluvial fertile plains, almost featureless, formed mostly by the depositional process of the Himalayan and Vindhyan rivers.
- i) The eastern part of the Northern Plain is called the Rajasthan Plain.
- Flood Plain is known as "Dhaya" and the eroded Plain is known as "Chos
- k) The Luni drains into the Rann of Khambat
- I) The highest point is mount Girnar (1117m) of the Gir Range in central Kathiawar.
- m) Most of the Himalayan rivers are perennial.
- n) Tapti is an east flowing river.
- o) The Himalayan rivers are rain fed as well as snow fed.
- p) Narmada originates from the Yamunotri Glacier in the Himalayas.
- q) Famous city Leh lies on banks of the Luni.
- r) The intensity of rainfall decreases from east to west and from north to south in the northern plains.
- s) The Arabian Sea Branch of the south-west monsoons strikes the highlands of the Eastern Ghats at almost right angles

#### 2. Fill in the blanks :

- a. Encircling the ------the Himalayan Ranges take a sharp bend to the south and run in north eastern border of India.

- d. The Himalayas consist of ----- ranges from South to North.
- e. Longest tunnel of Asia (23/5Km long), ------ lies in this region.
- f. ----- is a grassland located to the east of the Marusthali.

- **g.** The new alluvium deposited near the banks of the Sutlej, Beas, Ravi, and Chenub River forming a plain is called \_\_\_\_\_.
- h. The highest peak of Peninsular India-\_\_\_\_\_ is 2695 metres above sea level.
- i. The\_\_\_\_\_\_ is one of the oldest fold mountains of the world that runs from north-east to south-west.
- **j.** The west coast has \_\_\_\_\_\_rivers coming down swiftly from the western slopes of the Western Ghats, the draining into the Arabian Seawithout forming any \_\_\_\_\_.
- **k.** The west coast of India, on the other hand, is both emergent and\_\_\_\_\_
- I. Krishna is the \_\_\_\_\_largest east flowing river of peninsular India.
- m. In West Bengal the river Ganga flow east ward and near \_\_\_\_\_\_ it is divided into two distributaries, Padma and Bhagirathi.
- n. When Padma is joined by the \_\_\_\_\_\_ it is known as Meghna.
- o. Chambal, Betwa and Son, the major tributaries of Yamuna come from the \_\_\_\_\_\_.
- p. Deccan Plateau receives less rainfall (60 cm), forms a \_\_\_\_\_\_\_
  \_\_\_\_\_\_ region.

#### 3. Multiple choice question

- a. The North-Eastern Himalayas run North to South
- I. through Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and eastern Assam.
- II. through Andhra Pradesh, Nagaland, Manipur, Mizoram, Tripura and eastern Assam
- III. through Arunachal Pradesh, Nagaland, Madhya Pradesh, Mizoram, Tamil Nadu.
- **b.** Kanchenjunga, which belong to the Sikkim Himalaya,
- i. is the highest peak of the world and the highest peak of Himalaya in India.
- ii. is the second highest peak of the world and the highest peak of Himalaya in India.

- iii. is the third highest peak of the world and the highest peak of Himalaya in India.
- c. The old alluvium is known as

i."Bhangar"

li. Kader

lii. Bet

**d.** The whole of West Bengal except the one district and the northern mountains comprises the Lower Ganga Plain. The district is:

- i. Puruliya
- ii. Bardhaman
- iii. Malda
- e. The Malwa plateau is located to the north
- i. of Aravalli and is composed of pink granite
- ii. of Vindhya and is composed of pink granite
- iii. of Anaimudi and is composed of pink granite
- f. The highest peak of Aravalli is
- i. Guru-Sikhar
- ii. AnaiMudi
- iii. NandaDevi
- g. Mount Girnar (1117m) is the highest point of the
- i. Aravalli
- ii. Gir Range

iii.Western Ghats

- h. Yamuna originates from the.
- i. Yamunotri Glacier in the Himalayas.
- ii. Gangotri Glacier in the Himalayas
- iii. Baltora Glacier in the Himalayas.
- i. Two Peninsular Rivers which flow westwards and make estuaries are
- i. The Narmada and Betwa.
- ii. The Narmada and Tapti
- iii. The Narmada and Luni.

.Ganga turns to the south east and enters West-Bengal near

- i. the Rajmahal Hills
- ii. Satpura Hills
- iii. Pareshnath Hills

#### 4. Answer the Following Questions

- 1. Write the names of the ranges of the Himalayas.
- 2. Mention the names of the countries in which the Greater Himalayas are situated.
- 3. Identify two purvanchal hills.
- 4. Write in short the origin of the Ganga Plain.
- 5. What are the salient features of the Sutlej Plain?
- 6. Describe Chhotanagpur Plateau.
- 7. Describe Malwa Plateau.
- 8. Compare the Eastern and Western Coastal Plains.
- 9. Classify Western coastal Plains and describe each division.
- 10. Write the names of the major rivers of the Himalayas.
- 11. Describe the course of the Indus river.
- 12. What are the characteristics of the Himalayan rivers?
- 13. Compare the Himalayan and Peninsular rivers.
- 14. Write in short the Mechanism of Monsoon.

# 1.17. ANSWERS TO THE SELF LEARNING QUESTIONS.

- 1. a) True
- 1. (b) False, South to North.
- 1. (c) True1(d) True
- 1(e) false, Deccan Plateau.
- 1(f) false, 3200 km
- 1(g) false, Peninsular
- 1(h)True
- 1(i)false, western
- 1(j) true
- 1(k)false, Kutch
- 1.(I) true
- 1. (m) True
- 1. (n) False, West.
- 1. (o) True
- 1. (p) False, Yamuna
- 1.(q) False, Indus
- 1.(r) True
- 1.(s) False, Western Ghats

- 2 .a.Namcha Barwa
- 2. b.Indian plate
- 2. c. highest plateau of India
- 2.d. four parallel
- 2e. Jawahar tunnel
- 2.f. Bagar
- 2.g."Bet"
- 2.h.Anai-Mudi (Nilgiris),
- 2.i. Aravallis
- 2. j. short, deltas
- 2.k. submergent.
- 2 .I.second
- 2. m.Dhulian
- 2. n.Brahmaputra
- 2.o. peninsular uplands four parallel
- 2. p. rain shadow
- 3. a.i.
- 3. b.iii
- 3.c.i.
- 3.d.i
- 3.e.ii.
- 3.f.i.
- 3.g.ii
- 3. h.i.
- 3. i.ii
- 3.j.i.

# 1.18. TECHNICAL WORDS:

- 1. Pass: It is a natural gap or a route between a ridges, hill.
- 2. **Range**: large landmass consisting of mountains, ridges and peaks.
- 3. **Peak**: highest point or tip of a mountain range.
- 4. Valley: a depression or a flat land between two elevated areas.
- 5. **Dun**: Longitudinal valleys existing between Himachal and Siwaliks.
- 6. **Emergence** Coastline of emergence is formed either by an uplift of the land or by the lowering of the sea level. Coastline of submergence is an exact opposite case.

- 7. A **tributary** is the river that meets the main river. Its base level is higher than the main river
- 8. **A distributary** is a small river that branches out from the main river and then never meets it again
- 9. River system– It is a river along with its tributaries.
- 10. **Estuary** An estuary is a partially enclosed body of water along the coast where fresh water from rivers and streams meets and mixes with salt water from the ocean. Estuaries and the lands
- 11. **Ferrel's Law** states that winds in the northern hemisphere are deflected to the right of its course.

# 1.19. TASK

- 1. Ina map of India show the different ranges of Himalaya from south to north.
- 2. In a chart compare the characteristics of Western coastal plain and eastern coastal plain.
- 3. In a map of India point out
- (i) Nanga Parbat and ii. Nanda Devi
- 4. Ina map of India show the different river systems of the Himalaya
- 5. In a chart compare the characteristics of Northern and Southern rivers of India.
- 6. In a map of India point out
- i. River Kaveri and ii. River Narmada
- 7. In a map of India show the two branches of South West Monsoon.

# **1.20. REFERENCES FOR FURTHER STUDY**

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# SOIL AND FOREST OF INDIA

After going through this chapter you will be able to understand the following features.

#### **Unit Structure**

- 2.1 Objectives
- 2.2 Introduction
- 2.3 Subject- Discussion
- 2.4 Soils of India
- 2.5 Forest of India
- 2.6 Summary
- 2.7 Check your Progress/ Exercise
- 2.8 Answers to the self learning questions.
- 2.9 Technical words and their meaning
- 2.10 Task
- 2.11 References for further study

# 2.1. OBJECTIVES

By the end of this unit you will be able to -

- understand the characteristics of Indian soil
- know the classification and distribution of soils of India
- understand the problems of Indian soil
- know the methods of soil conservation
- understand the Functions of forests
- know about the classification and distribution of Indian forest
- know about the problems of Indian forestry
- understand the National Forest Policy

# **2.2. INTRODUCTION**

In this chapter we will discuss on the followings

- 1. The characteristics of Indian soil, and its classification
- 2. The distribution of soils of India will also be studied.
- 3. Problems of Indian soil and different methods of soil conservation have also been taken into consideration.

- 4. After soil comes Functions of forest, its classification and distribution in India.
- 5. Problems of Indian forestry and National Forest Policy are another important feature which has been discussed in this chapter.

# 2.3. SUBJECT DISCUSSION

Soil can be simply defined as a mixture of small rock particles/debris and organic materials/ humus which develop on the earth surface and support growth of plants. India has a wide variety of land, rock, climate and natural vegetation and hence presents a large variety of soils. **Major classification of Indian soils include,** Alluvial soil, Red soil, Black or regur soil, Arid or desert soil, Laterite soil, Saline soil, Peaty or marshy soil, Forest soil, Mountain soil.

Indian soils suffer from a number of problems like, soil erosion, fertility loss, desertification, water logging, salinity and alkalinity, wasteland, urbanisation and transport development, and interference of man. Various methods have been followed to conserve soil degradation.

On the other hand, **forests** constitute an essential natural heritage. They are important economic assets, and essential for sustaining the global environment. Forests provide a wide range of goods, such as food, wood and fibre. The ecosystem services, such as climate regulation, water catchment protection, poverty reduction, spiritual fulfilment and aesthetic enjoyment are also some important functions of forest. Everyone depends on these goods and services, and many millions depend on forest-based employment for their livelihoods.

Depending on the climatic zones or location of the continents they have a wide variety of growth and hence are classified into different categories. This chapter is going to present a complete idea on the different types of forests of India.

#### 2.4. CHARACTERISTICS OF INDIAN SOIL

India has a wide variety of land, rock, climate and natural vegetation hence exhibits a large variety of soils. Soil is our prime natural and economic resource. Soils in India differ in composition

• To analyse the characteristics of Indian soil, it has been divided it into two essentially different sets, i.e.

# (1) North Indian soil and

(2) Peninsular or South Indian Soil.



Fig: India showing Types of soil

#### 1. North Indian Soil

- Features of North Indian Soil are as follows:
- Soils of the Great Plains of India are transported and deposited.
- The Northern India plains are mostly formed of deep alluvial soil.
- The topsoil varies in texture from sand to clay, the greater part being light loam, porous in texture, easily worked and naturally fertile.
- The great depth of the alluvium keeps down the soil temperature.
- This soil is supposed to be naturally very rich in the plantnourishing food, and is consequently very good for our rabi and kharif crops.
- Level plains, formed by this soil, have enabled the easy construction of railways and a network of canals.
- Last but not the least, the level character of the plains facilitates a more even distribution of rainfall in Northern India, having no barriers to check the flow of the monsoon currents.

#### 2. Peninsular or South Indian Soil

- Features of South Indian Soil are as follows:
- The soils in the Peninsular India are the soils formed by the decomposition rocks in situ.
- The hilly tracts are naturally unsuitable for cultivation.
- Some highlands are very hot.
- The river valley, are suitable for agriculture.
- The soil in the valleys is deeper, cooler and moisture retaining.
- In the rains, some of these tracts become sticky, in the dry weather hard and crumby, holding the moisture at lower levels.
- Millets and pulses are well grown in slopes.
- Thicker, dark-coloured, and more fertile valleys are rich in chemical properties favourable for plant life, and are very suitable for cotton, wheat, linseed and other rabi and kharif crops.

### 3. Rest of India

• The rest of the Indian soils cannot be grouped under any one head. Lowlands are sufficiently fertile and grow products like rice. Soils of Coastal India are composed of sediments deposited by rivers and the waves.

# 2.5. CLASSIFICATION OF SOILS OF INDIA

The Indian Agriculture Research Institute has divided the soils of the country into 27 types according to their colour, texture, mineral matter and retentive capacity of moisture. However, for the convenience of the discussion, the Soils in India are classified into the following **10 categories:** 

# \* Major classifications of Indian soils are as follows:

- 1. Alluvial soil [46%]
- 2. Red soil [18.5%]
- 3. Black / regur soil [15%]
- 4. Arid / desert soil
- 5. Laterite soil
- 6. Saline soil
- 7. Peaty and Marshy soil
- 8. Mountain Soil
- 9. Terai Soil
- 10. Alpine Grassland soil

# 1. Alluvial Soils:

Alluvial soil is the mostly available soil in India (about 46%) which covers an area of 143 sq. km.

- They are depositional soil, as they are transported and deposited by rivers, waves etc. and is fine grained.
- It is widespread in northern plains and river valleys. In peninsular-India, they are mostly found in deltas and estuaries. Indus-Ganga-Brahmaputra plain, Narmada-Tapti plain etc are the regions where alluvial soil is mostly found.
- Humus, lime and organic matters are present. This type of soil is highly fertile.
- New alluvium is termed as Khadar and old alluvium is termed as Bhangar.
- Colour of alluvial soil: Light Grey to Ash Grey.
- Texture of alluvial soil: Sandy to silty loam or clay.
- Sand content decreases from west to east of the country.
- Rich in: potash
- Poor in: phosphorous.
- Wheat, rice, maize, sugarcane, pulses, oilseed etc are cultivated mainly.
- These soils are renewed every year.
- Alluvial soils are of two types:

a) **Riverine Alluvial Soils:** formed by the deposition of silt, sand and clay in the river valleys. These are two types: New alluvium soil or **Khadar** and Old alluvium soil or **Bhangar**.

b) **Coastal Alluvial Soils:** these types of soils are formed by the deposits of sea waves. It is rich in sand and salt. It is moderately fertile.

#### 2. <u>Red Soil</u>

**Formation**: Red soils in India are mainly formed due to the decomposition of ancient crystalline and metamorphic rocks like granites and gneisses and from rock types rich in minerals such as iron and magnesium. It is red in colour because of ferric oxide.

**Area covered:** This soil covers almost the whole of Tamil Nadu, Karnataka, Andhra Pradesh, S.E. Maharashtra, and Chhattisgarh, parts of Orissa, Jharkhand and Bundelkhand.

**Nature of the soil**: Seen mainly in low rainfall area. These soils have a mixture of sand and clay. Red Soil is generally deficient in nitrogen, humus and phosphorus, but rich in potash. Red soil is porous. It is deficient in lime, phosphate, manganese, nitrogen, humus and potash. Texture is sandy to clay and loamy.

**Influence on Agriculture**: They are relatively less fertile, but are capable of growing good crops with the help of irrigation and fertilizers. It is suitable for rice, wheat, millet, gram, pulses, sugarcane, oilseeds, tobacco and vegetables and cotton. Also groundnuts and potatoes are cultivated on these soils at higher elevations

# 3. Black Soil / Regur Soil:

Black soils are black in colour owing to high content of humus, calcium, magnesium, carbonate and iron oxide. These are made up of volcanic rocks and lava-flow. It is concentrated over Deccan Lava Tract which includes parts of Maharashtra, Chhattisgarh, Madhya Pradesh, Gujarat, Andhra Pradesh and Tamil Nadu. As they are most suited for raising cotton crops, they are known as Black-Cotton Soils. Locally, they are known as Regur Soils. (Regur means cotton). It is a mature soil and has high water retaining capacity. It swells and becomes sticky when wet and shrink when dried. These soils are clayey in texture and contain mineral substances. These are also rich in Iron, lime, calcium, potassium, aluminium and magnesium and deficient in nitrogen, Phosphorous and organic matter. These soils are fertile and suitable for the production of cotton, jowar, sugarcane, wheat and groundnut. Oranges, onion and green skinned bananas grow here in abundance.

#### 4. Laterite Soil:

• **Formation**: Laterite Soils are formed due to intense leaching. They occupy the slopes of the mountains of peninsula, in the Vindhyas, the Eastern Ghats, and the southern portion of Western Ghats. They are commonly found in Kerala, Tamil Nadu, Maharashtra, Chhattisgarh, Chotanagpur, Karnataka and hilly areas of Orissa and Assam. They are red in colour and coarse with a high content of iron-oxides. It becomes soft when wet and hard when dried. It is rich in iron and aluminium but deficient in nitrogen, potash, potassium, lime and humus. Agriculture is practised only by the application of fertilizer and irrigation water. Rice, Ragi, Sugarcane and Cashew nuts are cultivated mainly. Other than these, rubber, tea, coffee etc. are also grown in some areas.

#### 5. Desert Soils:

These soils are formed due to scarcity of rainfall and excessive evaporation in arid and semi-arid regions in India. Desert Soils are found in the desert regions of Rajasthan, where soils are not well developed. It is also found in the southern parts of the Punjab and Rann of Kutch. As evaporation exceeds rainfall, the soil has a high salt content and saline layer forms a hard crust. These soils contain coarse brown sands and are very porous having low nitrogen and humus content. Desert soil lacks moisture and humus. In this type of soil kankar or impure calcium carbonate content is high which restricts the infiltration of water. It has a sandy and relatively coarse texture as the fine top soils are blown away by winds. These soils are not suitable for agriculture due to scanty rainfall. However, agriculture can be carried on with the help of irrigation. Bajra, jowar, wheat, oilseed, groundnut can be grown on these soils.

#### 6. Saline and Alkaline Soils

In the drier parts of Bihar, Uttar Pradesh, Haryana, Punjab, Rajasthan and Maharashtra alkaline soils are found. It is known by different names: Reh, Kallar, Usar, etc. The accumulation of salts makes the soil infertile and renders it unfit for agriculture.

#### 7. Peaty and Marshy soil

Peaty and Marshy soils, contain considerable amounts of soluble salts and 10 – 40% of organic matter. Peaty soils are found in Kottayam and Alappuzha districts of Kerala, where it is called Kari. Marshy soils are found in areas of heavy rainfall and high humidity like Northern Bihar, coastal parts of Orissa, Tamil Nadu and West Bengal and parts of U.P. A large quantity of dead organic matter/humus makes the soil alkaline. Growth of vegetation is less in this soil.

#### 8. Mountain Soil:

a) These soils are formed as a result of the accumulation of organic matter derived from forest growth. The remains of the leaves of trees enrich the soil with humus. They are found in the mountain regions of the country, i.e. Himalayan region. These soils vary in different regions according to altitude. Mountain Soil is immature soil with low humus and acidic. These soils are of various types such as Brown soils, Podzols, etc. They are fertile and suitable for cultivation of potatoes, rice, wheat, fruits and tea. These are good for the growth of Oak trees. Tea is grown in those areas which receive sufficient rainfall. Very good for orchard crop. There are two types Mountain Soil, a. Forest Soils b.Glacial Soil

#### 9. Tarai Soils:

These soils are found on the foot-hill regions of the Himalayas in India and are composed of gravels and coarse grained sand. They are popularly known as 'bhabar'.

#### 10. Alpine Grassland Soils:

These soils are found on higher altitudes of the Himalayas where alpine grasses grow. These soils are acidic and are of medium fertility. On these soils barley, maize, potatoes and wheat are grown.

# 2.6. PROBLEMS OF SOILS IN INDIA

## The problems of Indian Soils are discussed below:

## 1. Soil Erosion -

- The removal of the uppermost layer of the earth's crust either by physical causes or by anthropogenic causes is known as **soil** erosion.
- The main agents of soil erosion are water, wind, sea-waves, glaciers, and shifting cultivation among which water is the most important and pronounced one. Lakhs of tons of fertile soil are washed away by running water due to heavy downpour during rainy seasons.
- Water erosion may be classified under three categories like surface erosion, rill erosion and gully formations. For example prominent gully erosion is viewed in the Chambal valley in Madhya Pradesh.
- On the other hand in arid and semi-arid regions of north-western India, loose particles of **top soil are blown by wind.**
- ✤ <u>The adverse effects of soil erosion are reflected in the following points</u>:
- 1. Erosion of top soil leads to loss of soil fertility and fall in agricultural productivity.
- 2. Flooding and leaching result in loss of mineral nutrients.
- 3. Ground water level is lowered and there is decrease in soil moisture.
- 4. With the drying up of Natural vegetation cover, arid lands expand.
- 5. Frequency and intensity of floods and drought increases.
- 6. Rivers, canals and tanks are silted and their water holding capacity decreases.
- 7. The incidence and damaging power of landslides increases.
- 8. Economy as a whole suffers a great setback.

# 2. Declining Soil Fertility:

India being an agricultural country soil is utilised for cultivation since time immemorial. Multiple cropping without fallowing the agricultural land is practised for centuries. But the natural fertility of soil is declining very fast. The unscientific rotation of crops (wheat and rice) over several decades has depleted the soil fertility in the Great Plains of India substantially. The cultivation of leguminous crops after a soil exhaustive crop can improve the soil fertility affected regions.

#### 3. Water-Logging:

When the water table rises to the extent, that soil pores in the root zone of a crop become saturated that area is said to be waterlogged. This results in the restriction of normal circulation of the air, decline in the level of oxygen, and an increase in the level of carbon dioxide. Water logging has affected substantial tracts of land along the Indira Gandhi Canal (Rajasthan) and the canals of Punjab, Haryana, and Uttar Pradesh. Water logged areas may be reclaimed by adequate development of drainage and lining of the canals to reduce water seepage.

## 4. Soil salinity and alkalinity

Soil salinity and alkalinity are found in the relatively less rainfall recording areas where the rate of evaporation is generally higher than the rate of precipitation. Cultivation is not possible on saline soils unless they are flushed out with large quantities of irrigation water to leach out the salts. So, when soil fertility is reduced it results in crop failure.

#### 5. Desertification:

The spread of desert like conditions in arid or semi- arid areas due to man's influence or climatic change may be defined as desertification. The process of desertification is attributed to various causes like uncontrolled grazing, reckless felling of trees and growing population and climate changes.

#### 6. Urbanisation and Transport Development

Due to urbanization, water holding capacity of the soil decreases and runoff rate increases which in turn led to soil erosion.

#### 7. Interference of Man:

Human activity on the earth's surface is known to cause soil degradation ten times more than naturally occurring processes. Agriculture and construction are the two ways in which humans cause erosion. Construction when unnecessarily conducted can be quite damaging to soil. Agriculture is also another cause of erosion because humans move the top soil and make it prone to erosion. Over-fertilization of soils used for agricultural and horticultural purposes is a growing environmental concern.

# 2.7. METHODS OF SOIL CONSERVATION

Soil conservation includes all those measures which help in protecting the soil from erosion and exhaustion. Several Methods of

Soil conservation have been adopted in India. More than 40 million hectares of land in India have been reclaimed from water erosion, wind erosion and gully erosion. Raindrop erosion has been checked by creating grassland cover. Following methods are generally adopted for soil conservation:

• **Afforestation:** The best way to conserve soil is to increase area under forests. By afforestation soil erosion may be checked as the trees keep the soil tight with their roots. In this method unplanned cutting of trees has also been checked.

• **Checking Overgrazing**: Overgrazing of forests and grass lands by animals, especially by goats and sheep, should be properly checked, because animals grazing freely in the fields spoil the soil by their hoofs leading to soil erosion.

• Scientific methods of cultivation: This method has been implemented in a number of areas to check soil erosion by unscientific cultivation. Contour farming is also introduced.

• Educating the tribal people: To check soil erosion by Jhum cultivation, a programme of educating the tribal people has been taken by the govt. of India.

• Changes in our agricultural practices: We can save lot of our valuable soil by bringing about certain changes in our agricultural practices such as (i) Crop Rotation, (ii) Strip Cropping, iii.)Use of Early Maturing Varieties seed, (iv) Contour Ploughing, (v) Terracing and Contour Bunding, (vi) Checking Shifting Cultivation, (vii) Ploughing the Land in Right Direction.

• **Ploughing the Land in Right Direction** : Ploughing the land in a direction perpendicular to wind direction also reduces wind velocity and protects the top soil from erosion.

• One of the important methods of Soil Conservation planned in India is to check wind erosion by **planting of trees in the opposite direction of the wind**.

• **Planned development of roads and railway:** With the help of planned development of roads and railway, injudicious removal of soil has been checked in India.

• **Constructing Dams:** constructing dams across the rivers checks the speed of water and saves soil from erosion.

# 2.8. FOREST OF INDIA

**Definition of Forest:** Forests are one of the most important natural resources of the earth and about 1/3rd of the earth's total area is covered by the same. In India 02% of the country's geographical area is now under green cover (as per 2009 data) whereas the total forest cover in India is 6,90,899 km2. Sustainably managed forests fulfil a range of functions to the benefit of both man and nature. Forests are not only important as suppliers of wood but also play a vital role as protectors of soil, water, and climate. Forest's role as a protector flora and fauna is important too. As areas for recreation and relaxation for human beings, forests are indispensable.

✤ Functions of Forests : The functions of forest may broadly classified into following categories:

**1. Protective Function** - Forest provide protection against Soil erosion, Droughts, Floods, Noise, Radiations

**2. Productive Function** – Forest provide various products like, gum, resins, medicines, katha, honey, pulp, bamboo, timber, and fruits

**3. Regulative Function** – The Forest regulates the level of Oxygen and carbon dioxide in atmosphere. The forests also help in regulating temperature conditions

**4. Accessory Function** - Forest provides aesthetics, habitat to various flora and fauna besides that it also has a recreational value.



Fig: functions of forest

# 2.9. CLASSIFICATION OF FORESTS IN INDIA

#### Introduction:

India has a diverse range of forests, from the rainforest of Kerala in the south to the alpine pastures of Ladakh in the north in one hand and from the deserts of Rajasthan in the west to the evergreen forests in the northeast on the other. While classifying the forests into different types, the main factors that have been taken into consideration include soil type, topography, and elevation.

- Primarily, there are 5 major groups, namely:
- 1) Tropical Evergreen Forests
- 2) Tropical Deciduous Forests
- 3) Tropical Thorn Forests and Scrubs
- 4) Montane Forests
- 5) Mangrove Forests



Fig: Types of vegetation in India

#### 1) TROPICAL EVERGREEN FORESTS

#### ✤ Characteristics:

- These forests are restricted to **heavy rainfall** areas receiving more than **200 cm of rainfall** with a short dry season.
- The **areas include** are the Western Ghats and the island groups of Lakshadweep, Andaman and Nicobar, upper parts of Assam and Tamil Nadu coast.
- The trees reach great heights up to 60 metres or even above.
- Since the region is warm and wet throughout the year, it has a luxuriant vegetation of all kinds trees, shrubs, and creepers giving it a multilayered structure.
- There is no definite time for trees to shed their leaves. As such, these **forests appear green** all the year round.
- Some of the **commercially important** trees of this forest are ebony, mahogany, rosewood, rubber and cinchona.
- The **common animals found** in these forests are elephants, monkey, lemur and deer. The one horned rhinoceros are found in the jungles of Assam and West Bengal. Besides these animals plenty of birds, bats, sloth, scorpions and snails are also found in these jungles.
- 2) Tropical Deciduous Forests or Monsoon Forest
- Characteristics:
- These are the most widespread forests of India.
- These forests are found in the region receiving rainfall between 200cm and 70 cm.
- Trees of this forest-type shed their leaves for about six to eight weeks in dry summer.
- On the basis of the availability of water, these forests are further divided into:
- a. Moist Deciduous And
- B. Dry Deciduous
- a. Moist Deciduous -
- This type of forest is found in areas receiving rainfall between 100 and 200 cm
- These forests exist mostly in the eastern part of the country north eastern states, along the foothills of the Himalayas, Jharkhand, West Orissa and Chhattisgarh, and on the eastern slopes of the Western Ghats.

- Teak is the most dominant species of this forest. Bamboos, sal, shisham, sandalwood, khair, kusum, arjun, mulberry are other commercially important species.
- b. Dry Deciduous.
- The dry deciduous forests are found in areas having rainfall between **100 cm and 70 cm**.
- **These forests are found** in the rainier parts of the peninsular plateau and the plains of Bihar and Uttar Pradesh.
- Teak, Sal, Peepal, Neemare the important species that grow in these forests.
- The **common animals** found here are lion, tiger, pig, deer and elephant. A huge variety of birds, lizards, snakes, and tortoises are also found here.

#### 3. THE THORN FORESTS AND SCRUBS

#### ✤ Characteristics:

- The natural vegetation consists of thorny trees and bushes in the regions which receive less than 70 cm of rainfall.
- This type of vegetation is found in the north-western part of the country including semi-arid areas of Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Uttar Pradesh and Haryana.
- Acacias, palms, euphorbias and cacti are the main plant species.
- Trees are scattered and have long roots penetrating deep into the soil in order to get moisture. The stems are succulent to conserve water. Leaves are mostly thick and small to minimize evaporation. These forests give way to thorn forests and scrubs in arid areas.
- In these forests, the common animals are rats, mice, rabbits, fox, wolf, tiger, lion, wild ass, horses and camels.

#### 4. MONTANE FORESTS

- Characteristics:
- In mountainous areas, temperature decrease with the increase in altitude. This leads to the corresponding change in natural vegetation also.
- As a result, a succession of natural vegetation belts in the same order is observed from the tropical to the tundra region.
- The classification of Montane forests are as follows:
- a. The wet temperate type of forests -
- These are found between a height of 1000 and 2000 metres.

- b. Evergreen broad-leaf trees -
- Between 1500 and 3000 metre trees like oaks and chestnuts predominate.
- c. Temperate forests -
- These types of forests contain coniferous trees like pine, deodar, silver fir, spruce and cedar.
- These forests cover mostly the southern slopes of the Himalayas, places having high altitude in southern and northeast India.

#### d. Temperate grasslands -

• These are common at higher elevations.

#### e. Alpine vegetation -

- At high altitudes, more than 3,600 metres above sea-level, exists the Alpine vegetation.
- Silver fir, junipers, pines and birches are the common trees of these forests. However, they get progressively stunted as they approach the snow-line.

#### f. Alpine grasslands -

- By gaining altitude and through shrubs and scrubs, Alpine vegetation merges into the Alpine grasslands.
- These are used extensively for grazing by nomadic tribes like the Gujjars and the Bakarwals.

#### g. Tundra Vegetation -

- At higher altitudes, mosses and lichens form part of tundra vegetation.
- The common animals found in these forests are Kashmir stag, spotted dear, wild sheep, jack rabbit, Tibetan antelope, yak, snow leopard, squirrels, Shaggy horn wild ibex, bear and rare red panda, sheep and goats with thick hair.

#### 5. MANGROVE FORESTS

#### Characteristics:

- The mangrove tidal forests are found in the areas of coasts influenced by tides.
- Dense mangroves are the common varieties with roots of the plants submerged under water.
- The deltas of the Ganga, the Mahanadi, the Krishana, the Godavari and the Kaveri are covered by such vegetation.
- In the Ganga- Brahmaputra delta, sundari trees are found, which provide durable hard timber.

- Palm, coconut, keora, agar, also grow in some parts of the delta.
- Royal Bengal Tiger is the famous animal in these forests. Turtles, crocodiles, gharials and snakes are also found in these forests.
- ✤ The various types of forests in India as recognised by Champion are discussed below:
- Champion (1936) recognized 13 major types of forest in India.

Champion and Seth (1968) recognized sixteen types of forest which are listed below.

The following types of forests are found in India which covers nearly **17 per cent** of the total area of Indian territory.

## 1. TROPICAL FOREST:

A great majority of the forests found in India are of this type. Tropical forests are of two types

#### (A) Tropical moist forests.

(B) Tropical dry forests.

#### (A). Tropical moist forests:

These are further classified into the following types on the basis of relative degree of wetness:

# (i) Tropical moist evergreen forests,

# (i) Tropical moist semi-evergreen forests, and

# (iii) Tropical moist deciduous forests.

(iv) Littoral and swamp forests include the following types:

- a. Beach forests
- b. Tidal forests or Mangrove forests
- c. Fresh water swamp forests.

**(B). Tropical dry forests.** These are classified into the following three types:

- I. Tropical dry evergreen forests,
- II. Tropical dry deciduous forests, and
- III. Tropical thorn forests.

## 2. SUBTROPICAL MONTANE FORESTS:

These forests are found in the region of fairly high rainfall but where temperature differences between winter and summer are less marked.

- I. Wet hill broad leaved forests,
- II. Dry evergreen forests, and
- III. Pine forests.

## 3. TEMPERATE MONTANE FORESTS:

• These forests occur in the Himalayas at the altitude from 1800 to 3800 metres where humidity and temperature are comparatively low.

Montane forests have been classified into the following three types on the basis of moisture regime:

- I. Montane Wet temperate forest,
- II. Himalayan Moist temperate forest, and
- III. Himalayan Dry temperate forest

# 1. SUB-ALPINE FORESTS:

• The sub-alpine forests are found throughout Himalayas from Ladakh in the west to Arunachal in the east at the altitude from 2800 m to 3800 m.

Champion (1939) has recognized the **following two types of forests in sub-alpine zone**:

(a) Sliver Fir-Birch forests which are found on glacial moraines

(b) Birch-Rhododendron forests which grow on rocky substrata.

#### 5. ALPINE FORESTS:

• Alpine vegetation has been classified into the following three types:

- I. Alpine forests,
- II. Moist Alpine scrubs, and
- III. Dry Alpine scrubs.

# 2.10. PROBLEMS FACED BY THE INDIAN FORESTRY

Although Indian subcontinent exhibit varied types of forests ranging from the rainforest of Kerala in the south to the alpine pastures of Ladakh in the north and from the deserts of Rajasthan in the west to the evergreen forests in the northeast, it face a number of problems which are both natural and manmade. Here one point must be noted that India has 99 National Parks, 513 wildlife sanctuaries and 14 Biosphere Reserves.

- The main problems faced by the Indian Forestry are stated under:
- 1. Inadequate and Dwindling Forest Cover:
- The forest cover in India is only 21 per cent as against the world average of about 35 per cent. It is noted that the **National Forest Policy of India 1952**, has recommended that the overall desired forest area in India should be 33 per cent (25 per cent in plains and 60 per cent in hilly regions) of the total geographical area of the country.
- **Unequal Distribution** The distribution of forests is uneven. On the one side, in Himachal Pradesh, Kerala, Assam and M.P., about 33% area is under forests. In the more populated areas like Punjab, only 5% forest area.
- Vast forest tracts have been cleared for agriculture, and in this case Shifting Cultivation in the wet mountainous regions of the country, has played a pivotal role.
- **Over grazing** is very much responsible for serious damage to forests.

#### 2. Low Productivity:

- Productivity of Indian forests is very low as compared to some other countries. For example, annual productivity of Indian forest is only 0.5 cubic metres per hectare while it is 1.25 cubic metres per hectare in the USA, 1.8 cubic metres per hectare in Japan and 3.9 cubic metres per hectare in France.
- The reasons for low productivity are as follows:
- a. **Uneven distribution and inaccessibility** of forest causes difficulty in exploitation of the same.
- **b. Uncontrolled felling,** without regenerating the forest covers through compensatory forestry, is still primitive and indigenous

in most of the forests. This damages the ecosystem, leads to more soil erosion and delays the regeneration of forests.

- c. Lack of proper transport and infrastructure facilities.
- d. Over-utilisation due to unregulated grazing.
- e. **Depletion o**f forests through fire is the result of inadequate protection against forest fire.
- f. Lack of protection also lies in insects, pests and plant diseases.
- g. **Poor and unscientific methods** of felling, fashioning and seasoning.
- h. **Unscientific economic activities** like slash and burn manner of agriculture which destroy the fragile forest cover of slopes.
- i. **Reliance on static conservancy**, i.e., natural growth, rather than regenerating through Afforestation.
- j. Lack of information on forest resources and inadequate research facilities.
- k. **Degradation of forest** covers due to industrial and irrigation projects, illegal felling or '**poaching**' etc.
- I. There are inadequate trained personnel in forestry.

#### 3. Nature of Forests and their Uneconomical Utilisation:

• The forests are thick, inaccessible, slow growing and lack in gregarious stands in many parts of the country. These factors make their utilization uneconomical because there is a good deal of wastage and this makes it very expensive in spite of the cheap labour available in India.

#### 4. Lack of Transport Facilities:

• About 16 per cent of the forest land in India is inaccessible and does not have proper transport facilities.

• The major product of the forests is timber which is cheap but a bulky commodity. So, it cannot afford high freights charged by the railways and roadways. Therefore, Indian forests cannot be economically exploited without the availability of cheap and efficient transport facilities.

#### 5. Forest Fires:

- Large tracts of vegetal cover are destroyed every year by forest fires.
- Forest fires in India are most destructive in dry season.
- Insufficiency of properly trained personnel is a big handicap.

### 6. Plant Diseases, Insects and Pests:

• Large tracts of forest cover suffer from plant diseases, insects and pests which lead to considerable loss of forest wealth. For example, thousands of hectares of sal forests in Madhya Pradesh and Chhattisgarh are being threatened by sal borer for which no remedial measures have been adopted so far.

# 7. Obsolete Methods of Lumbering and Sawing:

• In most of the Indian forests, obsolete methods of lumbering, sowing etc. are practised. This system leads to a lot of wastage and low forest productivity.

## 8. Lack of Commercial Forests:

• In India most of the forests are meant for protective purposes and commercial forests are badly lacking.

## 9. Lack of Scientific Techniques:

• Only natural growth of forests takes place in India whereas in many developed countries new scientific techniques are being used through which tree growth is quickened.

## **10. Undue Concessions to Tribals and Local People:**

• In vast forest tracts, tribals and local people have been granted customary rights and concessions for free-grazing as well as removing timber fuel and minor forest products. They are also allowed to continue with age-old shifting cultivation.

#### 11. Growing Demand for Agricultural Land

With the tremendous increase in population during the last 50 years, the demand for cereals and agricultural raw materials has increased significantly.

#### • 12. Urbanisation and Industrialisation

Fast urbanisation and industrialisation in the forest and hilly areas has also caused forest degradation. Hill stations like Shimla, Mussoorie, Dehra-Dun, Nainital, Ranikhet, Chamba, Dalhousie, etc. has increased over ten times during the last thirty years at the cost of the natural vegetation.

# 13. Construction of Multi-Purpose Projects

The construction of reservoirs of big dams like Bhakra-Nangal, Rihand, Hirakud, Tehri, Sardar-Sarovar, etc. has resulted in the submergence of large forest tracts.

#### 14. Commercial Activities

Commercial activities like resin extraction, mining, quarrying, oil-extraction, plantation, orchard development have also led to large scale deforestation.

**15.** Low per Acre Productivity- The per acre productivity of forest is low. It is 1/10 of France, 1/21 of Japan and 1/6 of USA.

**16.** Low Per Capita Forest Area- The per capita forest area in India is 0.2 hectare, which is very low due to rapid growth of population.

#### ✤ Remedies:

- The following remedial measures may be suggested against the problems faced by the Indian forestry:-
- 1. Intensive development schemes for afforestation should be adopted. High yielding varieties should be planted in suitable areas.
- 2. Improved techniques of logging and extraction should be used.
- 3. Proper transport facilities should be provided to remote and inaccessible forest areas.
- 4. Saw mills should get uninterrupted power supply.
- 5. Latest techniques of seasoning and preservation are necessary to avoid wastage.
- 6. Proper arrangements to save forests from fires and plant diseases can go a long way to solve several problems.
- 7. A thorough inventory of forest resources is necessary to make an accurate assessment of our forest resources and make plans for their proper use.
- 8. Shifting cultivation should be discouraged and tribals depending on this type of cultivation should be provided with alternate sources of livelihood.
- 9. People associated with forest protection should be properly trained.

# 2.11. THE NATIONAL FOREST POLICY OF INDIA

#### Introduction:

Very few countries in the world have forest policy. India is one of them having forest policy in operation since **1894**. The policy was revised in **1952** and again in **1988**.

Since **1947**, India government has been quite concerned about the necessity of developing forestry in the country. In **1950**, Van Mahotsava was inaugurated. Moreover, a Central Board of Forestry was set up, to evolve an all India forest policy. ✤ There are two forest policies in the history of Independent India, 1952 and 1988.

• National Forest policy of 1952:

According to the **National Forest policy of 1952**, it was decided to raise the area under forest upto 100 million hectares steadily. **This policy** recommended that the country should aim at coverage of one-third of the total land area under forest i.e. 60 per cent in hilly and mountainous areas, and 25 per cent in the plains. It has suggested the extension of tree-lands on river/canal banks, roads, railways, culturable waste and in such areas which are not suitable for cultivation.

To achieve this goal, it was necessary to reduce the long range development of forest resources and meet the growing demand for timber and firewood.

- The National Forest Policy 1952 classified the Indian forests into four categories:
- 1. Protected forests essential for physical and climatic needs.
- 2. **National forests** to be utilised for the economic needs of the country.
- 3. **Village forests** to meet the fuel and domestic needs of villages and neighbouring towns.
- 4. **Tree lands**. The policy envisaged the annual organisation of **Van Mahotsava** and tree plantation week in the month of July-August.
- The National Forest Policy 1952 lays emphasis on:
- a) **Weaning the tribal people** by persuasion to desist from shifting cultivation.
- b) Implementation of forest laws more effectively as well as awakening people's Interest- The forest policy stressed that it would be the duty of the forester to awaken the interest of the people in the development, extension and establishment of tree law wherever possible and to make them tree minded.
- c) To provide **adequate facilities** for the management of forest resources.
- d) To **control grazing** of cattle, sheep and goats in forest areas.
- e) **Providing fuel-wood** to rural areas.
- f) To improve the availability of timber wood for industrial purposes.

- g) To increase the area under social forestry.
- h) To promote **research** in forestry.
- i) Indiscriminate Extension of Arable Land- It is advocated that indiscriminate extension of land, through deforestation, should be discouraged because it not only deprives the local population of wood, grass, etc. but also deprives the land of its natural defence.

#### • The National Forest Policy 1988:

The main emphasis of the revised **forest policy of 1988** is on protection, conservation regeneration and development of forests. According to the Forest Policy Resolution of 1988, forest cover of country should not be less than 33% of the total geographical area. Replacing old forest policy of 1952, Govt. Of India announced new forest policy in December 1988.

- The main points of the National Forest Policy 1988 are:
  - I. **Maintenance of environmental stability** through the preservation and restoration of ecological balance.
  - II. **Conservation of forests** as a natural heritage with vast varieties of flora and fauna.
- III. Control of soil erosion and denudation in catchment areas of rivers, lakes and reservoirs.
- IV. Check on the extension of sand-dunes in desert areas of Rajasthan and along sea-coasts.
- V. **Substantial increase in forest cover** through massive afforestation and social forestry programmes.
- VI. To **meet the needs** of fuel-wood, fodder and minor forest products for the rural and tribal people.
- VII. Augment the productivity of the forests to meet national needs.
- VIII. Encouragement of efficient utilisation of forest produce and optimum substitution of wood.
  - IX. **Steps** to create **massive movement** of people with the involvement of **women folk to** achieve these objectives and to minimise pressure on existing forests.
  - X. Involvement of people in **forest management** under joint forest management.
  - XI. Withdrawing the System of Private Forest Contract- The forest policy states to cancel totally the system of forest contractors working in the forests.

- XII. This policy also stresses upon the need to distribute the minor forest products through state-run depots.
- XIII. **Discouraging Forest Based Industries** No forest based enterprises would be permitted to establish in future unless the projects have been cleared after a thorough assessment of the availability of raw materials from the forests.

## 2.12. SUMMARY

Soil is a natural resource like water and minerals which occurs on earth's surface. It is the unconsolidated mineral and organic matter mixed with liquids and gasses. It is a medium capable of supporting growth of rooted plants and differs substantially from the material from which it is derived. Its composition includes inorganic material, organic material, water, and air. The colour of soil varies from light yellow, red to black. Each colour indicates the constituent of soil, like, Black: high organic content, Yellow/red/orange: iron content, Light gray-white: content calcium or silica.

The characteristics of soils result from the proportion of silt, clay and sand, and the interactions with air, water and living things. Soil structure is the arrangement of soil particles into various sizes and shapes.

Although Natural vegetation, as the name goes grow naturally, are considered as one of the most valuable gifts of mother nature. Forests supply us fruits, timber, medicines, etc. from the trees. They are found in different parts of the world, in different climatic zones, different continents.

A wide range of natural vegetation grows in India and these vary according to climate, soil and altitude. A study of the distribution of the forests in India reveals that there is a marked relation between the rainfall zones and their belts of natural vegetation.

The principal types of natural vegetation in India: like (1) Tropical Evergreen Rain Forests, (2) Dry and Wet Deciduous Type of Forests, (3) Semi Desert and Desert Vegetation, (4) Tidal or Mangrove Forests and (6) Mountain Forests., have been discussed in this chapter.

# 2.13. CHECK YOUR PROGRESS/ EXERCISE

### 1. True and false

a) Rill erosion in one kind of erosion in which the running water makes finger-shaped grooves in the land.

- b) The Northern India plains are mostly formed of deep alluvial soil.
- c) Erosion of top soil increases soil fertility and agricultural productivity.
- d) Soil salinity and alkalinity are found in the heavy rainfall recording areas.
- e) Low Mangrove Forests grow on soft tidal mud near estuaries, which is flooded by salt water.
- f) Tropical Evergreen Forests are restricted to very low rainfall areas.
- g) Fast urbanisation and industrialisation in the forest and hilly areas has caused forest degradation.

#### 4. Fill in the blanks :

- a) Laterite soils are \_\_\_\_\_ in colour and coarse with a high content of \_\_\_\_\_.
- b) \_\_\_\_\_erosion is significant in the arid and semi-arid areas.
- New alluvium soil is known as \_\_\_\_\_
- d) \_\_\_\_\_ is the most dominant species of dry deciduous forest.
- e) There are two forest policies in the history of Independent India, \_\_\_\_\_ and \_\_\_\_\_.

# 5. Multiple choice question

a. Old alluvium soil is known as I.Bhangar II.Khadar III.Bet IV.Kankar

b. When the water table rises to the extent that soil pores in the root zone of a crop become saturated, that area is said to be

I.alkaline II.waterlogged III.flooded IV.wasteland

c. The soils that are formed by the deposits of sea waves are known as

I.Mountain soils II.Coastal Alluvial Soils III.Riverine Alluvial Soils IV.Red Soils d. Tropical moist semi-evergreen forests are found

I.along the eastern coasts, northern Orissa and upper Meghalaya where annual rainfall is between 200 and 250 cm.

- II.along the western coasts, eastern Assam and upper Bihar where annual rainfall is between 200 and 250 cm.
- III.along the eastern coasts, eastern Kerala and upper Assam where annual rainfall is between 200 and 250 cm.
- IV.along the western coasts, eastern Orissa and upper Assam where annual rainfall is between 200 and 250 cm.

# 2.14. ANSWER THE FOLLOWING QUESTION

- 1. What are the different types of soils found in India? Describe any two of them.
- 2. What is soil erosion?
- 3. What methods have been taken into consideration to combat soil erosion?
- 4. Write short notes on
- a) Alluvial Soil
- b) Black Soil
- c) Mountain Soil
- 5. Describe in short the problems of water logging in Indian soil.
- 6. What are the effects of Gully erosion on Indian soil?
- 7. What are the major forest types of India? Describe any three of them.
- 8. Write in short the problems faced by Indian forestry.
- 9. Write in short the aims of the National Forest Policy of 1988.

# 2.15. TECHNICAL WORDS AND THEIR MEANING

- 1. **Aggregates Soil** aggregates are soil 'lumps' of a range of sizes.
- Alluvium Alluvium is a deposit made by a river or running water. This leads to an 'alluvial deposit' forming in the water. Alluvial soils are rich agricultural lands. Glaciers may also deposit sedimentary material, see 'glacial till'.
- 3. **Erosion -** Erosion is the wearing away of land or soil through one or more processes. The main causes of erosion include the actions of water, wind translocation, and geological.

Erosion can also be increased by poor land management such as overgrazing, deforestation or inappropriate use of mechanisation.

- 4. **Humus** Organic matter, also called 'humus', forms from the decay of leaves, plants and other life.
- 5. **Loam** Loam is a soil which contains clay, silt and sand as well as organic material. Keen gardeners love loam it's the best soil for potting plants and growing seeds in the greenhouse. Loamy soils are ideal also for agricultural crops.
- 6. **Parent material-** Soil parent material refers to the rocks which were weathered to form the soil in the first place. Usually the parent material is below the soil, but it can be distant if glaciers translocated the soils during the ice ages. Parent material is the focus of the study of geology.
- 7. **Photosynthesis -** Photosynthesis is a process in plant cells in which the sun's energy is used to join carbon dioxide and water to make sugar, the food of green plants.
- 8. **Pores -** A soil pore is the hole in-between particles of soil that can become filled with air or water.
- 9. **Precipitation** Precipitation means water reaching the ground from rainfall, snow and hail.
- 10. **Saline soil-** Soil containing sufficient soluble salts to interfere with plant growth.
- 11. **Sand** That mineral fraction of the soil with particles from 0.063 2.0 mm in diameter fine sand: 0.063 0.212 mm in diameter medium sand: 0.212 0.6 mm in diameter coarse sand: 0.6 2.0 mm in diameter.
- 12. **Sediment** Sediment is a deposit of 'alluvium' laid down in water (such as lakes or the sea). Sediments can, over time, form rocks such as chalk and limestone.
- 13. **Soils Acidity** Most soils are of a pH from about 5.5 to 8, this is a large range but some soils can be pH 3 (see pH), which is very acidic.
- 14. **Topsoil** Topsoil is the surface layer of soil containing partly decomposed organic debris, and which is usually high in nutrients, containing many seeds. Topsoil is usually a dark colour due to the 'organic matter' present. In arable land, 'topsoil' refers to the soil down to plough depth.
- 15. **Water holding capacity** Can the soil hold lots of water like a sponge? If so it has a large 'water holding capacity'. Soil organic matter increases the water holding capacity. Pure running sand has a low water holding capacity.

# 2.16. TASK

- 1. In a map of India show the major soil regions of India.
- 2. In a chart show the classification of Indian forest made by Champion.
- 3. In a map of India show five major forests of India.

# 2.17. KEY TO THE ANSWER

- 1.a. true
- 1.b. true
- 1.c. false, leads to loss of soil fertility and agricultural productivity
- 1.d. false, relatively less rainfall areas
- 1.e. true
- 1.f. false, heavy rainfall
- 1.g. true
- 2.a. red, iron-oxides
- 2.b. Wind
- 2.c. Khadar
- 2.d.Teak
- 2.e.1952 and 1988.
- 3. a.i.
- 3.b.ii.
- 3.c.ii.
- 3.d.iv.

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97

# AGRICULTURE, FISHERY, MINERALS AND POWER RESOURCES OF INDIA

After going through this chapter you will be able to understand the following features.

# **Unit Structure**

- 3.1 Objectives
- 3.2 Introduction
- 3.3 Subject- Discussion
- 3.4 Agriculture
- 3.4.1 Land Utilisation
- 3.4.2 Characteristics and Problems of Indian Agriculture
- 3.4.3 Cropping Pattern
- 3.4.4 Livestock Resources
- 3.4.5 White Revolution
- 3.5 Fisheries
- 3.5.1 Development and distribution of Fisheries
- 3.5.2 Blue Revolution
- 3.5.3 Problems and solutions related to fishing
- 3.6 Major Minerel India Resources of
- 3.7 Power Resources of India
- 3.8 Summary
- 3.9 Check your Progress/ Exercise
- 3.10 Answers to the self learning questions.
- 3.11 Technical words and their meaning
- 3.12 Task
- 3.13 References for further study

# 3.1. OBJECTIVES

By the end of this unit you will be able to -

- Understand the characteristics and problems of Indian agriculture, cropping pattern of Indian agriculture and livestock resources
- Understand the definition of Blue Revolution.

- Know the Development and distribution of Fisheries
- Understand Blue Revolution
- Know the classification, distribution and problems Mineral resources of India
- Understand the classification, distribution and problems of Power resources of India.

# **3.2. INTRODUCTION**

In this chapter we will learn about Indian Agriculture, Fisheries, Minerals and Power Resources. Agriculture is the backbone of Indian economy and prosperity. India has a total land area of approximately 328 million hectares. Mostly, land utilisation statistics are obtainable for almost 93 % of the entire area that is around 306 million hectares.

## **3.3. SUBJECT DISCUSSION**

**Agriculture is the backbone of Indian economy**. To maintain ecological balance there must be sustainable development of agriculture sectors. The 11th Five year plan (2007-2012) emphasizes that agricultural development is necessary for rapid economic development of the country.

Most parts of India have subsistence agriculture, where the Indian farmer owns a small piece of land. He cultivates the land and grows crops with the help of family members.

Agriculture has to provide employment to a large section of work force and has to feed the teeming millions.

In spite of the large scale expansion of irrigation facilities since Independence, only one-third of the cropped area is provided by perennial irrigation and the remaining two-third of the cropped area has to bear the brunt of the vagaries of the monsoons.Indian agriculture also faces various problems like, Fragmented land holding, Irrigation problems, Seed problems, Sustainability problems.

Multiplicity of cropping systems has been one of main features of Indian agriculture and it is attributed to rain fed agriculture and prevailing socio-economic situations of farming community. India has numerous potentials in the fisheries sector like one of the longest coastlines of the world at 7500km, which has helped her to flourish in the field of fishery irrespective of several problems. Moreover, India is rich in many mineral resources.

India's power resources are also enviable.

# 3.4. AGRICULTURE

# 3. 4.1. Land Utilization in India

# Introduction:

Land use has been an important subject of geography since the 1930s, when the first land utilization survey was carried out by L. D. Stamp in Britain. The utilization of land depends upon physical factors like topography, soil and climate as well as upon human factors such as the density of population, duration of occupation of the area, land tenure and technical levels of the people. Land use pattern depending on such phenomenon is no exception in India and relates to the physical characteristics of land, the institutional and other resources framework like labour, capital available. All these aspects are associated with the economic development.

# 1. Reporting and Non-Reporting Land

The land for which the data on classification of land-use is available is known as Reporting Land. On the other hand, the lands where no data is available are known as Non-Reporting Lands.

2. Net sown area: Cropped area in the year under consideration is called **net sown area**. Although there is not much scope for increasing area under this category but an urgent need to increase the net sown area to meet the food and other requirements of rapidly increasing population in India is always felt. Around 1.3 % of the land is under fruit trees. Nearly 5 % of the land falls in the category of uncultivated land which is cultivated once every 2 to 3 years. The uncultivated lands are subsidiary lands and are kept so to re-establish their richness. Its use depends upon high-quality and timely rains also. Madhya Pradesh has the largest net sown area of 19.89 million hectares which is about 13.89 per cent of the total reporting net sown area of India. Large parts of the Ganga plains, Gujarat plains, Kathiawar plateau Satlui. Maharashtra plateau and West Bengal basin have high proportion of cultivated area. This is largely due to gentle slope of the land, fertile alluvial and black soil, favourable climate, excellent irrigation facilities and high density of population. In contrast, mountainous and hilly areas in the Himalayan region and some of the drier tracts are not much suited to farming because of rugged topography, unfavourable climate and infertile soils.

**3. Area sown more than once:** Under this category, the area is used to grow more than one crop in a year accounting for over 34. 3 per cent of the net sown area and 16.6 per cent of the total reporting area of the country. This type of area comprises of land with rich fertile soils and regular water supply. Large tracts of the Indo-Ganga plain in Punjab, Haryana, Uttar Pradesh and Bihar and in coastal regions have large percentage of area sown more than once.

4. Forests: For a self-sufficient economy and accurate ecological steadiness, at least one third of the total land area must be kept under forests and natural vegetation but forested land in India is far less in scientific norm. It should be noted that, 22.23 per cent of forest land to the total reporting area is not sufficient for a tropical country like India where about 33 per cent of the total land should be under forests. Massive tree plantations and vigorous restrictions on the reckless felling of trees is required to fulfil this criteria,

**5.** Land not available for cultivation: Two types of land come under this class i.e.

a. land put to non agricultural uses and b. barren and unculturable waste.

Land put to non agriculturaluses includes land occupied by villages, towns, roads, railways or under water i.e. rivers, lakes, canals, tanks, ponds, etc. On the other hand the barren land covers all barren and uncultivated lands in mountains and hill slopes, deserts and rocky areas. These areas cannot be brought under plough except at high input cost with possible low returns. The amount of this land has been variable right from 1950-51 to 1999-2000, the data for which are available.

#### 6. Permanent pastures and other grazing lands:

The area separated as cultivable waste, has remained stationary at around 6.4 % for several decades. Land under permanent pastures is despondently low and suggests a remarkable population pressure on the land. A total area of **11 million hectares** is devoted to permanent pastures and other grazing lands. This amounts to about 4 per cent of the total reporting area of the country. Grazing takes place mostly in forests and other uncultivated land wherever pasturage is available. About one-third of the reporting area in Himachal Pradesh is under pastures. The proportion varies from 4 to 10 per cent in Madhya Pradesh, Karnataka, Gujarat, Rajasthan, Maharashtra and Orissa. It is less than 4 per cent in the remaining parts of the country. 7. Land under miscellaneous tree crops and groves include all cultivable land which is not included under net area sown, but is put to some agricultural use. Land under casuarina trees, thatching grass, bamboo, bushes, other groves for fuel, etc. are not included under orchard but are classed under this category. Orissa has the largest area of 7.74 lakh hectares in this category followed by Uttar Pradesh (5.47 lakh hectares), Bihar (3.44 hectares), Karnataka (3-05 lakh hectares), Andhra Pradesh (2.43 lakh hectares), Assam (2.36 lakh hectares) and Tamil Nadu (2.43 lakh hectares).

## 8. Culturable waste:

According to the "wasteland survey and reclamation committee", "culturable waste" is the land available for cultivation but not used for cultivation for one reason or the other. Characteristics of culturable waste is that, this land was used in the past but has been abandoned at present due to such constraints as lack of water, salinity or alkalinity of soil, soil erosion, water-logging, an unfavourable physiographic position, or human neglect. Reh, bhur, usar, and khola tracts of Uttar Pradesh, Punjab and Haryana as well as in several other parts of the country were used for agriculture in the past but had to be abandoned due to some deficiencies in the soil resulting from faulty agricultural practices.

Fallow lands: Fallow lands include all that land which was 9. once used for cultivation but is temporarily out of cultivation. Fallow land is of two type i.e., (a). current fallow- Fallow of one year is called 'current fallow', (b). fallow other than current fallow - fallow of 2 to 5 years is classified as 'fallow other than current fallow'. Fallow land is left uncultivated from 1 to 5 years to help soil recoup its fertility in the natural way depending upon the nature of soil and the nature of fanning. The largest area of over 2.5 million hectare of 'fallow land other than current fallow' is in Rajasthan followed by 1.4 million hectares in Andhra Pradesh and over one million hectares in Maharashtra. The distribution of the current fallow on the other hand presents a slightly different picture. Andhra Pradesh with about 2.8 million hectares has the largest area as current fallow. This is followed by over 2.6 million hectares in Raiasthan, 1.8 million hectares in Bihar, 1.4 million hectares in Karnataka, 1.08 million hectares in Tamil Nadu.

# 3.4.2. Characteristics and Problems of Indian Agriculture

**Agriculture** refers to all those activities which are related to cultivation of land for the production of crops. India is essentially an agricultural country where agriculture plays a pivotal role in dominating the economic, social and cultural life of the people.

After independence in **1947**, there has been a progress in all fields of agricultural activities. More land has been brought under

irrigation, use of fertilizers and pesticides has increased and highyielding varieties have been introduced in many parts of India.

# • Following are some of the broad characteristics and problems of the Indian agriculture:

# 1. Subsistence agriculture:

• Indian agriculture is subsistent type of agriculture whose prime aim is to meet the food and other requirements of its vast population.

• The farmer owns a small piece of land grows crops with the help of his family members and consumes almost the entire farm produce. They select the crops with major objective of meeting their domestic needs rather than generating surplus for national and international markets.

• It is only in the controlled irrigated parts of the country like Punjab, Haryana, western Uttar Pradesh, and Kaveri delta where agriculture has become an agri-business or is market oriented.

## 2. Mixed Cropping

• Mixed cropping, a characteristic of subsistent agriculture is a common practice especially in the rain fed areas of India .The farmers mix millets, maize and pulses in the kharif season and wheat, gram and barley in the Rabi season. In the areas of shifting cultivation, ten to sixteen crops are mixed and sown in the same field.

#### 3. Small and Fragmentation of holding:

Due to physical, economic and social factors the landholdings are tiny, fragmented and not suitable for modern methods of agriculture. The main reason for fragmented land holdings is our inheritance laws, and other socio-cultural and economic factors. The land belonging to the father is equally distributed among his sons but this distribution does not entail a collection or consolidated one, but its nature is fragmented. As a result the holdings become smaller and more fragmented with each passing generation. The problem of small and fragmented holdings is more serious in densely populated and intensively cultivated states like Kerala, West Bengal, Bihar and eastern part of Uttar Pradesh where the average size of land holdings is less than one hectare and in certain parts it is less than even 0.5 hectare.

• Problems caused by Sub-division and fragmentation of the holdings:

a) Low agricultural productivity and backward state of our agriculture.

#### 104

- b) A lot of time and labour is wasted in moving seeds, manure, implements and cattle from one piece of land to another.
- c) Irrigation becomes difficult on such small and fragmented fields.
- d) A lot of fertile agricultural land is wasted in providing boundaries.
- e) Under such circumstances, the farmer cannot concentrate on improvement.

• The only solution to this problem is the consolidation of holdings which means the reallocation of holdings which are fragmented, the creation of farms which comprise only one or a few parcels in place of multitude of patches formerly in the possession of each peasant.

4. **Pressure of population on agriculture**: It is increasing at a rapid pace with a rising trend in urbanization. About 70 per cent of the country's population derives its livelihood from agriculture and allied occupations.

# 5. Predominance and over dependence on traditional crops like rice and wheat:

Since Indian agriculture has to feed a large population, it has the predominance of the cultivation of food grains so production of food crops is the first priority of the farmers almost everywhere in the country. These cereals include rice, wheat, millet, gram, maize and pulses which are grown to meet the food requirements of India's vast population (1027 millions in 2001). In both the **Kharif** (summer) and the **Rabi** (winter) seasons, grain crops occupy the greater proportion of the cropped area. In fact, rice, maize, millets, bajra, ragi, and pulses are the dominant crops in the kharif season, and wheat, gram and barley occupy over three-fourth of the total cropped area in the rabi season. Moreover, if the farm output is skewed towards crops like rice, irrigation and ground water facilities are misused by farmers, which lead to a host of other problems.

#### 6. Variety of crops:

• India is a vast country with varied types of relief, climate and soil conditions. Therefore, there is a large variety of crops grown in India. Both the tropical and temperate crops are successfully grown in India. Very few countries in the world have a variety of crops comparable to that produced in India.

# 7. Primitive Technology and Importance of animals

Indian agriculture utilises a number of draught animals like bullocks, he buffaloes, camels etc. in agricultural operations such as ploughing, irrigation, threshing and transporting the agricultural products. The health and efficiency of draught animals is low which often retards the timely operations of sowing, weeding, and harvesting. Although the use of agricultural machinery is replacing animal and human power but the pace of progress is very slow and confined to rich sections of the cultivators.

# 8. Indian Agriculture is Labour Intensive; Lack of mechanisation:

In India, agriculture is a labour based enterprise in which most of the agricultural operations, like ploughing, levelling, sowing, weeding, spraying, sprinkling, harvesting, and threshing are carried on mainly by human hands. The use of machinery is still confined only to the rich farmers of Punjab, Haryana, and western Uttar Pradesh, plains of Uttarakhand, Bihar, Madhya Pradesh, Gujarat, and Maharashtra. In spite of the large scale mechanisation of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and implements like wooden plough, sickle, etc.

#### 9. Dependent upon Monsoon:

In the greater parts (over 56%) of the country, agriculture is mainly dependent upon monsoon which is uncertain, unreliable and irregular. Its variability in time and place has adverse effect on agricultural output. That is why when rain fails agricultural production is badly affected, scarcity prevails and prices reach sky high.

### 10. Inadequate Irrigation Facilities:

Irrigation is the most important agricultural input in a tropical monsoon country like India where rainfall is uncertain, unreliable and erratic in time and space. India can achieve sustained progress in agriculture if only more than half of the cropped area is brought under assured irrigation. This is testified by the success story of agricultural progress in Punjab Haryana and western part of Uttar Pradesh where over half of the cropped area is under irrigation. However, ill effects of over irrigation especially in areas irrigated by canals must be taken care of as large tracts in Punjab and Haryana have been rendered useless (areas affected by salinity, alkalinity and water-logging), due to faulty irrigation.

#### 11. Insignificant place to given fodder crops:

• India has the **largest population of livestock in the world** but Indian agriculture puts minimum attention on fodder crops. This together with lack of good pastures has detrimental effect over the development of dairy farming. Only four per cent of the reporting area is devoted to permanent pastures and other grazing lands. As the domestic animals are not properly fed their productivity is very low compared to international standards.

# **12. Seasonal pattern of agriculture:** India **has three major crop seasons.**

**Kharif** season starts with the onset of monsoons and continues till the beginning of winter. **Rabi** season starts at the beginning of winter and continues till the end of winter or beginning of summer. **Zaid** is summer cropping season in which crops like rice, maize, groundnut, vegetables and fruits are grown.

**13. Use of HYV Seed**: To achieve higher crop yields and sustained growth in agricultural production seed is considered as a basic input. Good quality seeds often do not reach small and marginal farmers because of exorbitant prices of better seeds. To solve this problem the Government of India established the National Seeds Corporation (NSC) in 1963 and the State Farmers Corporation of India (SFCI) in 1969. High Yielding Variety Programme (HYVP) was launched in 1966-67 as a major thrust plan to increase the production of food grains in the country.

# 14. Highest percentage of its geographical area under cultivation:

India has the highest percentage (53%) of its geographical area under cultivation in comparison to many countries (USA 16.3%, China 11.8%, Japan 14.9%, Canada 4.3%, etc.) of the world.

# 15. Intensive farming is carried on in limited areas:

In India intensive farming is carried on **in limited areas** and **as a result** per hectare yield of different crops is much lower than other countries of the world and India's total agricultural production is not very satisfactory and rewarding.

# **16. Low Productivity**

One of the main problems of Indian agriculture is its low productivity compared to the other agricultural countries. The main cause of low yield per hectare is the low fertility of soil and less care to replenish it through green-manure, fertilisers, fallowing, scientific rotation of crops.

# 17. Lack of Definite Agricultural Land Use Policy

In the absence of a definite land use policy, the farmers grow crops according to their convenience which leads to excess of production and sometimes scarcity.

# 18. Lack of Storage Facilities

Storage of food grains is a big problem as a result nearly 10 per cent of our harvest goes waste every year in the absence of proper storage facilities. T

# 19. Lack of Marketing Facilities

Lack of marketing facilities and the role of brokers deprive the farmers to fetch remunerative prices for their agricultural products.

# 20. Inadequate transport:

One of the main handicaps with Indian agriculture is the lack of cheap and efficient means of transportation. Most roads in the rural areas are Kutcha (bullock- cart roads) and become useless in the rainy season. Under these circumstances the farmers cannot carry their produce to the main market and are forced to sell it in the local market at low price.

# 21. Scarcity of capital:

Agriculture is an important industry and requires capital. The role of capital input is becoming more and more important with the advancement of farm technology.

## 22. Low Status of Agriculture in the Society

In greater parts of India, agriculture is not considered as a dignified and honourable profession which leads to disappointment and lack of enthusiasm among most of the farmers. The younger generation of farmers prefer a petty government job to agriculture. Rich farmers invest their agricultural profits in non-agricultural sectors which are more remunerative.

#### 23. Land Tenancy

In many parts of the country, there are absentee land lords and the tillers are not having the rights on agricultural land.

#### 24. Poverty and Indebtedness of the Farmers

Cultivators' indebtedness is universal in subsistent farming. Its impact is very crushing in India. Over 85 per cent of all the cultivating families are under debt.

# 25. Inadequate Agricultural Research and Education, Training, and Extension

Though enough progress has been made in the field of agricultural research, there is no co-ordination between the farm and research laboratories in the different agro-climatic regions of the country. Hence, gains of new agricultural researches are not reaching the common cultivators, especially the marginal and small farmers

# 3.4.3. Cropping Pattern in India

#### ✤ Introduction

A cropping system refers to a set of crop systems, making up the cropping activities of a farm system. **Multiplicity** of cropping systems has been one of main features of Indian agriculture and it is attributed to rain fed agriculture and prevailing socio-economic situations of farming community.

# \* Factors Affecting Cropping Pattern in India

• The cropping patterns differ from region to region. It is highly influenced by climatic, personal, social, cultural and economic factors of the farmers. The major factors are:

# i) Size of the Land Holding

• In India marginal and small farmers represents the majority of farming community.

• So the **mono crop** paddy has become predominant as it fulfils the household needs and perpetuates the **subsistence agriculture** with little scope for commercial crop husbandry.

# ii) Literacy

• Majority of the farmers are ignorant of the scientific methods involved in mixed-cropping, mono cropping and other technological knowhow for practicing better.

## iii) Disease and pest

• The cropping pattern also depends on the possibility of disease and pest infections.

# iv) Ecological Suitability

• The cropping pattern of a particular region is highly dependent on the ecological condition (temperature, rainfall, humidity, etc.).

#### v) Moisture Availability

• The source of irrigation greatly determines the type of the cropping pattern to be practiced.

• For example, in low rainfall area, dry land farming is best possible way to profit maximisation.

# vi) Financial Stability

• The economic condition of the farmers also affects the cropping pattern.

• As the cash crops (for example, cotton) involve high capital investments, these are practised only in estate farming.

• The marginal section of the farms community adopts low cost crops.
# Changes in the Cropping Patterns

- I. The trend in the land use pattern and cropping pattern over last 50 years in India has shown **increasing use of land for the purpose of cultivation with slight variations**.
- II. **Vastly affected by rapid urbanization**: The higher cultivable area has been achieved by bringing large acreage of uncultivable land into cultivation.
- III. Influence of economic factors: Indian agriculture is increasingly getting influenced more and more by economic factors as factors like irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimize the role of non-economic factors in crop choice.
- IV. The major change in cropping pattern that has been observed in India is a substantial area shift from cereals to non-cereals.
- V. As we consider the share of individual crops within cereals, although the share of cereals as a group has declined, the **area share of rice has increased** continuously over all the four periods.
- VI. Thus, the area loss of cereals can be attributed entirely to the **declining area share of coarse cereals**, especially sorghum, pearl millet, barely and small millets.
- VII. Within oilseeds, the crops showing steady improvement in their area share are: rapeseed and mustard, soybean and sunflower.

# Prevalent Cropping Systems

Variation in cropping pattern has been one of the main characteristics of Indian agriculture.

- In India, the cropping pattern follows **two distinct seasons**;
- 1. Kharif season from July to October and
- 2. **Rabi** season from October to March.
- 3. The crops grown between March to June called **Zaid**.

# 1. The Kharif Season Cropping Patterns

The kharif season cropping patted comprises mainly rice and non-rice-based crops.

#### a) Rice based cropping pattern

• Rice is the best crop in this category and 9% of the area in India comes under rice-based cropping pattern. The eastern and southern regions, comprising Assam, West Bengal, Coastal Orissa,

Coastal Andhra Pradesh, Karnataka, Tamil Nadu and Kerala come under this cropping pattern.

# b) Kharif cereals other than the rice-based cropping pattern

• Maize, jowar, bajra form the main kharif cereals. Maize is grown in high rainfall areas, jowar in medium rainfall areas and Bajra in low rainfall areas.

• It is mainly concentrated in Karnataka, Tamil Nadu and Andhra Pradesh. These states account for more than 60% of the total area under this crop.

# c) Maize-based cropping pattern

• The largest areas under kharif maize are: Uttar Pradesh(14 mha), Madhya Pradesh (0.58 mha) and Punjab (0.57 mha).

# d) Kharif jowar-based cropping pattern

• The area under Kharif jowar in India is highest in Maharashtra (7.5 ha) closely followed by Madhya Pradesh 2.3 mha. Rajasthan, Andhra Pradesh, Karnataka and Gujarat, are other states under this cropping pattern.

# e) Bajra-based cropping pattern

• The area under bajra crop is about 12.4 mha. Rajasthan has about two-third of the total area. Maharashtra, Gujarat and Uttar Pradesh together constituting the remaining one-third area under the bajra crop.

# f) Groundnut based cropping pattern

• Groundnut is sown over an area of about 7.2 mha mostly in five groundnut producing states: Gujarat (24.4%), Andhra Pradesh, (20.2%), Tamil Nadu (35.5%), Maharashtra (12.2%) and Karnataka (12%). Five other states, viz, Madhya Pradesh, Uttar Pradesh, Punjab, Rajasthan and Orissa together have about 17.3% of the total area under groundnut as base crop.

# g) Cotton-based cropping pattern

• Cotton is grown over 7.6 mha in India.

• Maharashtra shares 36%(2.8mha), follows by Gujarat with 21% (1.6 mha), Karnataka with 13% (1 mha) and Madhya Pradesh with 9%(.6mha) of the area. The other cotton growing states are Punjab, Andhra Pradesh, Tamil Nadu, Haryana and Rajasthan.

# 2. Rabi-season Cropping Patterns

The major cropping patterns prevalent in India during the rabi season are: a) Wheat and gram based cropping pattern, and b) jowar-based cropping pattern.

# a) Wheat and gram based cropping patterns

• These two crops are grown under identical climate and can often be substituted for each other. On the all-India level, about 19 cropping patterns have been identified with wheat and 7 cropping patterns with gram.

# b) Rabi-Jowar based cropping patterns

• On the all India level about 13 cropping patterns have been identified with the rabi jowar.

• Maharashtra has the largest number of these cropping patterns wherein starting with the exclusive rabi jowar, bajra, pulses, oilseeds and tobacco are grown as alternative crops.

# **\*** There are different ways of growing crops.

• **Mixed Cropping:** Growing of two or more crops concurrently and blend together on the same piece of land without row arrangements is called **Mixed Cropping**. This lessens risk and gives some insurance against failure of one of the crops.

• **Intercropping:** Another way is **intercropping.** It is growing two or more crops simultaneously on the same field in a definite pattern. A few rows of one crop alternate with a few rows.

• **Crop Rotation:** The growing of different crops on a piece of land in a pre-planned succession is called **crop rotation**.

# ✤ The area under each crop in a given region may be classified under four groups:

- 1. High yield, high spread
- 2. High yield, low spread
- 3. Low yield, high spread
- 4. Low yield, low spread

It is apparent that there is **countless micro dissimilarity in the cropping patterns.** The most important element of farming in India is the production of grains and the dominant food-chain is grain man. On this basis, the country may be **divided broadly into five agricultural regions.** 

- i. **The rice region** extending from the eastern part to include a very large part of the north-eastern and the south-eastern India, with another strip along the western coast.
- ii. **The wheat region**, occupying most of the northern, western and central India.

- iii. The **millet-sorghum region**, comprising Rajasthan, Madhya Pradesh and the Deccan Plateau in the centre of the Indian Peninsula.
- iv. The **temperate Himalayan region** of Kashmir, Himachal Pradesh and Uttar Pradesh and some adjoining areas. Here potatoes are as important as cereal crops (which are mainly maize and rice), and the tree-fruits form a large part of agricultural production.
- v. The **plantation crops region** of Assam and the hills of southern India where good quality tea is produced.

# \* Current Cropping Patterns

With the new concepts of multiple-cropping and accumulation of useful scientific information, work on different crop combinations and sequential growth of the crops are coming up. In this respect, cultivated areas in the country can be broadly classified into three categories based on rainfall pattern:

### 1. Area Where Annual Rainfall is above 1150 Mm

Most of the areas in Assam, Kerala, Orissa and West Bengal can be included in the first category. Basic problems in these areas pertain to limited irrigation and poor drainage. Most of the farmers are engaged in rice cultivation.

#### 2. Area Where Rainfall Ranges from 750-1150 Mm

Large parts of Tamil Nadu, Uttar Pradesh and Andhra Pradesh fall in the second category and occupy about one third of the total cultivated area in the country. In these areas there is large potential for creating minor irrigation facilities.

#### 3. Area Where Rainfall is below 750 Mm

The third category also occupies nearly one third of the cultivated area, comprising parts of Andhra Pradesh, Karnataka, Maharashtra and Rajasthan. In these areas, unless major and medium irrigation facilities are provided, there is little hope for raising cropping intensity to a substantial extent.

It is clear that there are innumerable micro variations in the cropping patterns, which cannot be described in this note, some broad contours of farming emerge. The most important element of farming in India is the production of grains and the dominant food-chain is grain-man.

#### 3.4.4. Livestock Resources of India

**Livestock are integral part of farming system in Indian Agriculture**. It contributes manifold to the growth and development of agricultural sector. • Livestock includes animal husbandry, dairy and fishery sectors. It plays an important role in the national economy and in the socio-economic development of the country. Its role in the rural economy is also very important. It is an integral component of Indian agriculture supporting livelihood of more than two-thirds of the rural population, as supplementing family incomes and generating gainful employment in the rural sector, particularly among the landless labourers, small and marginal farmers and women's.

• India's livestock sector is one of the largest in the world. It has 56.7% of world's buffaloes, 12.5% cattle, 20.4% small ruminants, 2.4% camel, 1.4% equine, 1.5% pigs and 3.1% poultry.

• In 2010-11 **livestock generated outputs worth Rs 2075 billion** (at 2004-05 prices) which comprised 4% of the GDP and 26% of the agricultural GDP. The total output worth was higher than the value of food grains

• Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households.

• They are a natural capital, which can be easily reproduced to act as a living bank with offspring as interest, and an insurance against income shocks of crop failure and natural calamities.

• Driven by the structural changes in agriculture and food consumption patterns, the utility of livestock has been undergoing a steady transformation.

• The non-food functions of livestock are becoming weaker. Importance of livestock as source of 'draught power' has declined considerably due to mechanization of agricultural operations and declining farm size.

• Use of dung manure is increasingly being replaced by chemical fertilizers. On the other hand, their importance as a source of quality food has increased.

• Sustained income and economic growth, a fast-growing urban population, burgeoning middle income class, changing lifestyles, increasing proportion of women in workforce, improvements in transportation and storage practices and rise of supermarkets especially in cities and towns are fuelling rapid increases in consumption of animal food products. • Between 1983 and 2004, the share of animal products in the total food expenditure increased from 21.8% to 25.0% in urban areas and from 16.1% to 21.4% in rural areas.

# Population of Livestock and Its Importance

• According to 17th censes of the livestock, their existing population is 485002. The day by day increase of the same indicates its importance as an **alternative source of income and food**.

• It is an **important source of draught power, manure for crop production and fuel for domestic use**. It minimizes the use of non renewable energy.

• Livestock make a positive contribution to the economic development. Near about 70% of livestock market in India is owned by 67% of small and marginal farmers and by the land less. So, Livestock sector is an important source of income for the farmers and rural poor peoples.

• This sector contributed important share in export of Indian international trade. The livestock sector contributed over 5.26 per cent to the total GDP during 2006-07. According to estimates of the Central Statistical Organization (CSO), the value of output from livestock and fisheries sectors together at current prices was about Rs.2,82,779 crore during 2007-08 which is about 31.6 per cent of the value of the output of Rs.8,94,420 crore from agriculture & allied Sector.

# **Production of Milk**

• India produced 13.1 per cent of the total milk produced in the world attaining the first rank in milk production in the world. In 1950-51 production of milk in India was only 17 million tonnes (MT), which has increased to 108.5 million tonnes in 2008-09. Although there is a higher growth rate, the per capita availability of milk in India, 252 grams per day, is lower than the world average of 265 grams per day.

• Concentrated dairy products such as skimmed milk continues to be the largest item of export, which together accounts for nearly 78% of net milk and milk product exports during 2007-08.

#### Poultry and Egg

• **Poultry** is one of the fastest growing segments of the agricultural sector in India today. Their growth rate has been rising at 8 to 10 percent per annum.

• India is now the world's fifth largest egg producer and the eighteenth largest producer of broilers. Table eggs and broiler meat are the major end products of the poultry sector in India.

• The organized sector of poultry industry is contributing nearly 70% of the total output and the rest 30% in the unorganized sector in India.

• The Andhra Pradesh, Tamil Nadu and Maharashtra producing nearly 70% of the country's egg production.

• Poultry exports are mostly to Maldives and Oman. Indian poultry meat products have good markets in Japan, Malaysia, Indonesia and Singapore.

# Fish Production

• India has about 5.70 million ha of fresh water area suitable for fisheries production. Fishing, aquaculture and allied activities are reported to have provided livelihood to over 14 million persons in 2006-07.

• In 2001 overall fish production was 5666 thousand tonnes it gradually increasing continuously. At present, India's total fish production is about 76.21 thousand tonnes.

• This sector has great potential to export their fish and fish product.

# Meat and Meat Products

• Although with rapid urbanization, higher income levels and changes in lifestyle, market for scientifically produced and hygienically packed meat and meat products are expanding rapidly but in India the meat products industry is very much in the unorganized sector. Cattle, buffaloes, sheep, goat, pigs and poultry are the types of animals, which are generally used for production of meat.

• There is an increasing demand of meat and meat products in domestic as well as in the foreign market, particularly to the Gulf and West Asia and neighbouring countries.

• The country has 3,600 slaughterhouses, 9 modern abattoirs and 171 meat-processing units licensed under the meat products order. The production of meat has increased 1.9 million tonnes to 23 million tonnes from 2001 to 2007.

• In meat and meat processing sector, poultry meat is the fastest growing animal protein in India.

# \* Benefits of Livestock Sector Developments in India

• Animal Husbandry sector provides large self-employment opportunities. This sector is playing very important role in the rural economy as support sector of the economy. Especially 70 million rural households primarily, small and marginal farmers and landless labourers in the country are getting employment opportunities in dairy. Dairying has become an important secondary source of income for millions of rural families. Poultry is also another way of getting food and food security in India. Apart from food security it has provides employment to about 1.5 million people. This provides subsidiary occupation to a large section of the society particularly to the people living in the drought prone, hilly, tribal and other remote areas where crop production on its own may not be capable of engaging them fully.

• Livestock Sector not only provides essential protein and nutritious human diet through milk, eggs, meat etc but also plays an important role in utilization of non-edible agricultural by-products. Livestock also provides raw material/by products such as hides and skins, blood, bone, fat etc.

# 3.4.5. White Revolution in India

# Introduction:

• White Revolution in India is the package programme adopted to increase the production of milk. It made our country selfsufficient in milk and this was achieved entirely through the cooperative structure. Today around 12 million farmers in more than 22 states across the country own around 250 dairy plants handling around 20 million litres of milk a day.

• Prof. Verghese Kuerin was the father of White Revolution in India. The White Revolution in India occurred in 1970, when the National Dairy Development Board (NDDB) was established to organise the dairy development through the cooperative societies. Operation Flood has been spearheaded by the National Dairy Development Board (NDDB).

• The dairy development programme through **co-operative societies was first established in the state of Gujarat**. The co-operative societies were most successful in the **AnandDistrict** of **Gujarat**. The co-operative societies are owned and managed by the milk producers. These co-operatives provided financial help as well as consultancy.

# **Objectives of the co-operative society are as follows:**

1. The main objective of the co-operative society is the procurement, transportation, storage of milk at the chilling plants.

- 2. To provide cattle feed.
- 3. The production of wide varieties of milk products and their marketing management.
- 4. The societies also provide superior breeds of cattle (cows and buffaloes), health service, veterinary treatment, and artificial insemination facilities.
- 5. To provide extension service.

# The technology of White Revolution

- **The technology** of **White Revolution** is based on an extensive system of co-operative societies.
- Milk, after being collected at a village collection centre, is promptly transported to the dairy plant at the milk chilling centre.
- Timing of collection is rigidly maintained by the village society, truck operators, and the quick transport to the dairy plants. Milk tankers, each, normally carry 14,000 litres of milk.
- The chilling centres are managed by producers' co-operative unions to facilitate the collection of milk from producers who live at some distance from the chilling centres and thus, the middlemen are eliminated.

#### Phases of the White Revolution

The White Revolution may be examined under the following three phases:

#### 1. Phase I (1970-81)

- Phase I of Operation Flood was financed by the sale within India of skimmed milk powder and butter oil gifted by the EC countries via the World Food Program.
- As founder-chairman of the National Dairy Development Board (NDDB) of India, Dr Kurien finalized the plans and negotiated the details of EEC assistance.
- During this period, the dairy development programme was set up in ten states to provide milk to the cosmopolitan cities, i.e. Mumbai, Kolkata, Delhi, and Chennai.
- The important step in this phase was the setting up of 4 Mother Dairies in Mumbai, Kolkata, Delhi, and Chennai.
- 2. Phase II (1981-85)
- Milk powder production went up from 22,000 tonnes in the pre project year to 1,40,000 tonnes in 1989, thanks to dairies set up under Operation Flood.

- During this phase, the dairy development programme was extended in the states of Karnataka, Madhya Pradesh, and Rajasthan.
- In this phase, within 25 contiguous milk-shed areas (in 155 districts) a cluster of milk producers' union was established.
- The Research Institute at Hyderabad developed a vaccine called "Raksha" to control cattle diseases. The programme also involved the improvement in milk marketing in 144 more cities of the country.
- The Dairy Co-operative societies were set up in 35,000 villages and the membership exceeded 36 lakhs.

# 3. Phase III (1985-2000)

• A number of co-operative societies were set up in most of the major states of the country and the number of co-operatives went up by 73,000 with a membership of 10 million.

# ✤ Some of the important achievements of the White <u>Revolution are as under:</u>

- The importance of White Revolution in the dairy development is similar to that of Green Revolution to grain production. Today, India ranks first in milk production, accounting for 18.5 % of world production, achieving an annual output of 146.3 million tonnes during 2014-15. Gujarat, Maharashtra, U.P., Punjab, Haryana, Madhya Pradesh, Rajasthan, West Bengal, Andhra Pradesh, Karnataka, and Tamil Nadu are the main milkproducing states of the country.
- The import of milk and milk production has been reduced substantially.
- The per capita availability of milk in India has increased from 176 grams per day in 1990-91 to 322 grams per day by 2014-15. This represents a sustained growth in availability of milk and milk products for the growing population.
- Dairying has become an important secondary source of income for millions of rural households engaged in agriculture.
- To ensure the success of Operation Flood Programme, **research centres have been set up** at Anand, Mehsana, and Palanpur (Banaskantha). Moreover, three regional centres are functioning at Siliguri, Jalandhar, and Erode. Presently, there are metro dairies in 10 metropolitan cities of the country, beside 40 plants with capacity to handle more than one lakh litres of milk.

- Livestock Insurance Scheme was approved in February 2006 and in 2006-07 on a pilot basis in 100 selected districts across the country. The scheme aims at protecting the farmers against losses due to untimely death of animals. In most of the villages the cattle are kept under unhygienic conditions.
- To **improve the quality of livestock**, extensive cross breeding has been launched.
- For ensuring the maintenance of disease-free status, major health schemes have been initiated.

To conclude it may be said that the success of the dairy industry has resulted from the integrated co-operative system of milk collection, transportation, processing and distribution, conversion of the same to milk powder and products, to minimize seasonal impact on suppliers and buyers, retail distribution of milk and milk products, sharing of profits with the farmer, which are ploughed back to enhance productivity and needs to be emulated by other farm produce/producers.

#### \* <u>Problems and Prospects</u>

Some of the important problems of the White Revolution are as follows:

- 1. Collection of milk from the remote areas is expensive, time consuming, and not viable economically.
- 2. In most of the villages the cattle are kept under unhygienic conditions.
- 3. The marketing infrastructure needs much improvement, as there are inadequate marketing facilities.
- 4. The cattle breed is generally inferior.
- 5. The extension service programme is not effective.

#### ✤ <u>Conclusion</u>

India now has a surplus of milk and is gearing up to export milk powder. In India, dairy development has a great future. Many corporate sector firms like Indana (plants at Nagpur, Hyderabad, and Bangalore), The Sheel International and Milk and Food, and the Amrut Industries are taking advantage of the existing situation of liberalisation and globalisation. The government has constituted Technology Mission for dairy development and Amul Model Cooperatives are being promoted to cover about 60 per cent of the total area of the country.

# **3.5. FISHERIES**

# 3.5.1. Development and Distribution of Fishery

It is known that in eastern India the traditional practice of fish culture in small ponds existed for hundreds of years. Fish culture received notable attention in the state of Tamil Nadu as early as 1911, and subsequently, states such as Bengal, Punjab, Uttar Pradesh, Baroda, Mysore and Hyderabad initiated fish culture through the establishment of Fisheries Departments and support to fishers and farmers for expansion of the sector.

# Development of Fisheries

- Fishery sector occupies an important place in the socioeconomic development of the country as it plays an important role in the economic activity. It is a flourishing sector with varied resources and potentials. It stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food, at the same time it is an instrument of livelihood for a large section of economically backward population of the country.
- More than 6 million fishers in the country depend on fisheries and aquaculture for their livelihood.
- Fish production in the country has been showing an increasing trend and has reached a record level of 5.65 million tonnes in 1999-2000.
- India has a coastline of 8118 km and an EEZ (Exclusive Economic Zone) of 2.02 million sq km. About a million people are involved in fishing operations.
- India is the third largest producer of fish in the world and second in inland fish production (FAO 1998). India's share in the world production of fish has increased from 3.2% in 1981 to 4.5% at present.
- India is also an important country that produces fish through aquaculture in the world. India is home to more than 10 percent of the global fish diversity.

# During the Tenth five Year Plan it is proposed to give thrust to the following areas:

- Integrated development of riverine fisheries
- Habitat restoration and fisheries development of upland waters
- Development of reservoir fisheries
- Vertical and horizontal development of aquaculture productivity
- Management of coastal fisheries

- Deep-sea fisheries with equity participation
- Infrastructure development and improved post-harvest management
- Management and policy intervention including monitoring, control and surveillance
- Implementation of the code of conduct for responsible fisheries
- Gender programmes
- Strengthening of database and information networking

# \* <u>Distribution Of Fishery</u>

- In India every state and union territory have some contribution towards fish production but it is observed that over two-third of the output is mainly obtained from five states of West Bengal, Kerala, Gujarat, Maharashtra, and Tamil Nadu.
- In case of **marine fisherie**s Gujarat (22.07%) occupies the first place followed by Kerala (20.16%), Maharashtra (14.33%), and Tamil Nadu (3.09%).
- These four states together provide over 70 per cent of the marine fish production of the country.

#### State wise distribution of Fishery in India

#### 1. <u>KERALA</u>

- Kerala is the third largest producer of fish accounting for 11.52 per cent of the total fish production of the country and includes Kochi, Thiruvanathapuram, Kollam, Calicut, Baypore, Azhikode, Ponnani, Kannur,BaliapaUiam and Vizhinjam as the leading production centres in the state.
- **Matinees include** oil sardines, prawns, horse macken soles, shark and lactations in marine fisheries and barbus, mullet, clarius, prawns, merrels and e tropins in inland fisheries.
- The state has **cold storage facility** at Kochi, Calicut, Quilon, Thiruvanathapuram, Baypore, Azhikode, Emakulam, Kozhikode, Kayankulam and Tanur;
- A liver oil extraction plant at Kochi, and fish canning facilities at a number of places.
- There is regular transport of fish through refrigerated railway wagons from Kochi to Chennai.

# 2. WEST BENGAL

• Importance of West Bengal lies **in inland fisheries** accounting for 30.89% of the total production of the country.

- **Pisciculture is carried** on in numerous ponds, tanks, rivers, lakes and estuaries covering a total area of about 20,720 sq.km.
- **The important fish varieties include** rohu, catia, mrigal, hilsa, catfish, mackerel, shrimp and perches.

# 3. GUJARAT

- Gujarat being the second largest producer of fish in the country, contributes 22.07 per cent of the total production of marine fisheries and 1.41 per cent of the inland fisheries.
- The fishing area is largely located along die 1650 km long coastline from Lakhapat in the north to Umbargaon in the south consisting of 51 fishing ports and covering a total area of about 67,300 sq. km.
- Kandla, Dwarka, Poibandar, Navabandar, Bharuch, Jafferabad and Umbargaon are the main fishing centres.
- Bulk of the production is handled through 69 co-operative societies

# 4. MAHARASHTRA

- Maharashtra is the third largest producer (14.33%) of marine fisheries in the country. It contributes 9.30 per cent of the total production for fish in the country.
- Fishing activity is carried on all along the720km coastline with Mumbai, Ratnagiri, Alibag, Kolaba and Bassein as leading centres of production.
- Important fish varieties include Bombay duck, white pomfret, black pomfret, jew fish, Indian salmon, tummies, grey mullet, mackerel, eel, sardine, ribbon fish, shrimp, tuna, shark and prawn etc. Estuarine fisheries are well developed in Mahim and other creeks. The state has four fish farms in Bhandara, Kolaba, Pune and Parbhani districts. The cold-storage and canning facilities are available in Mumbai, Ratnagiri and Kolaba districts.

# 5. TAMIL NADU

- Tamil Nadu with a total coast line of 1,000 km occupies fourth (13.09%) and ninth (3.99%) place in respect of marine and inland fish-production of the country respectively.
- Chennai, Tuticorin, Ennore, Cuddalore, Mandapam, Kanniyakumari, Nagapattinam, and Cuddalore are main fishing ports.
- Main fish varieties include mackerel, soles, sardine, cat fish, ribbon fish, silver bellies and Jew fish.

# 6. ANDHRA PRADESH

- Andhra Pradesh is the fourth largest fish producing state of the country.
- It has important role both in terms of inland (second place) and marine (fifth place) fish production in India.
- The state with a total coastline of966 km has a total fishing area of 31,000 sq km. Vishakhapatnam, Kakinada, Machilipatnam, Bimlipatnam and Narasapatnam are the main fishing ports besides 350 fishing villages located along the coast.
- fish species include Jew fish, ribbon fish, mackerel, cat fish, sardine, silver bellies and soles.

# 7. KARNATAKA

- Karnataka contributes 11.52 per cent of the total fish production (marine fish 20.16% and inland fish 4.48%) of India.
- Mangalore, Karwar, Kumta, Ankola, Honavar, Malpe, Udiayawar, Bingi, Majali, Bhatkal, Chendia, Gangolli and Bokapatnam are main centres of fish production.
- Inland fishery is well developed in the creeks of the Netravati, Sharavati and Kali rivers. Main fish varieties are sardines, mackerel, seer fish, shark and prawn.

# 8. ORISSA

- Orissa is an **important producer of inland (4.87%) and marine (4.31%) fisheries in the** country.
- The river mouths of Mahanadi, Brahmani, and Swarnarekha, the brackish waters of the Chilka Lake and large number of tanks and ponds are the main areas of the fish production.
- Rohu, mrigal, perch, mackerel, prawn, hilsa, elopes; pomfrets, shrimp and croakers are the main fish varieties caught

# 9. BIHAR

- Bihar is the **third largest producer of inland fish** (7.81%) in the country.
- The bulk of the supply comes from the rivers (Ganga and its tributaries), reservoirs, ponds and tanks. Bhagalpur, Munger, Nalanda, Begusarai, Patna, Bhojpur, Saran, Siwan, Hazaribag, Giridih districts are the major producers.
- Apart of the fish production is sent to the neighbouring state of West Bengal

#### 10.ASSAM

• Brahmaputra river and its tributaries

# **11. MADHYA PRADESH**

• Rivers, tanks and ponds

# **12. UTTAR PRADESH**

• Ganga and its tributaries, ponds and lakes

# 13. Goa

• Creeks of the Zuari, M Sal and Arachol

# 14. OTHERS

The other important producers of fish in the country are stated under:

- I. Punjab;
- II. HimachalPradesh;
- III. JammuandKashmir;
- IV. Dam Diu etc.

# 3.5.2 Blue Revolution in India

# Introduction

- The term "blue revolution" refers to the remarkable emergence of aquaculture as an important and highly productive agricultural activity. Aquaculture refers to all forms of active culturing of aquatic animals and plants, occurring in **marine**, **brackish**, or **freshwaters.** It is the adoption of a package programme to increase the production of fish and marine products.
- The Blue Revolution in India was started in 1970 during the Fifth Five-Year Plan when the Central Government sponsored the Fish Farmers Development Agency (FFDA).
- Subsequently, the Brakish Water Fish Farms Development Agency was set up to develop aquaculture. The Blue Revolution has brought improvement in aquaculture by adopting new techniques of fish breeding, fish rearing, fish marketing, and fish export.
- There are more than 1800 species of fish found in the sea and inland waters of India, of which a very few are commercially important.
- The important sea fish include catfish, herring, mackerels, perches, mullets, Indian salmon, shell fish, eels, anchovies, and dorab. Similarly, the main fresh water fish include catfish, loaches, perches, eels, herrings, feather backs, mullets, carps, prawns, murrels, and anchovies.

- The fish production in the country has increased from 0.75 million tonnes in 1950-51 to 68.69 million tonnes in 2006-2007.
- Fishing, aquaculture and a host of allied activities, a source of livelihood to over 14 million people as well as a major foreign exchange earner, in 2005-06 contributed about one per cent of the total GDP and 5.3 per cent of the GDP from agriculture sector.
- The geographic base of Indian marine fisheries has 8118 km coastline, 2.02 million sq of Exclusive Economic Zone including 0.5 million sq km of continental shelf, and 3937 fishing villages.
- About 50 per cent of the country's total fish production comes from the inland fisheries including the freshwater fisheries like ponds, tanks, canals, rivers, reservoirs, and fresh water lakes.
- Marine fisheries contribute about 50 per cent of the total fish production of the country.
- Kerala is the leading producer followed by Maharashtra, Karnataka, Gujarat, and Goa. The Nellore District of Andhra Pradesh is known as the 'Shrimp Capital of India'.
- The fishing season extends from September to March. The higher fish production in the Arabian Sea is due to the broader continental shelf. The important fish varieties include sardines, mackerel and prawn.
- The East Coast contributes about 28 per cent of the total production of marine fish in the country. The fishing activity along the East coast is mainly carried on from Rameswaram in the south to Ganjam in the north, with fishing season from September to April along the Coromandal Coast.
- The National Fisheries Development Board has been set up to realise the untapped potential of fishery sector with the application of modern tools of research and development including biotechnology.

#### 3.5.3. Problems and solutions of Indian Fisheries

To put things in perspective, India is world's third largest producer of fish and comes next only to its neighbour China in terms of fish production. Current key management problems include:

#### Problems:

- 1. **Overexploitation** of the fishing resources of the territorial waters.
- 2. **Underutilization** of the deep sea resources

- 3. Low levels of mechanisations as dominated by unorganised sector and poor fisherman community
- 4. **Conflict** between fishing community and foreign trawlers over loss of livelihood hindering development.
- 5. Loss of biodiversity
- 6. Depletion of fish stocks
- 7. The adverse impact of climate change
- 8. **No well-planned strategy**, which has put the fishermen and the industry in some serious problems.
- 9. Any change in the ocean areas along the water table is bound to affect the produce. **Consistent degradation of shorelines and loss of coral reefs** have been major problems faced by India.
- 10. The **rise** of **sea surface temperature** even one degree will have a devastating impact on fisheries.
- 11. Lack of a reliable database relating to aquatic and fisheries resources Limited number of species grown / cultured, mainly due to weak linkages between research and development and fish farmers community.
- 12. Weak multi-disciplinary approach in fisheries and aquaculture.
- 13. Inadequate attention to the environmental, economical, social and gender issues in fisheries and aquaculture.
- 14. Inadequate HRD and specialized manpower in different disciplines.
- 15. Weak marketing and extension network Decline in fish catch and depletion of natural resources due to over exploitation of coastal fisheries.
- 16. **Water pollution**; unscientific management of aquaculture and contamination of indigenous germ plasm resources.
- 17. **Poor yield optimization**, problems in harvest and post-harvest operations, landing and berthing facilities for fishing vessels and issues in welfare of fishermen.
- 18. **Security of fishermen** is under stress especially who get arrested by neighbouring countries such as Sri Lanka and Pakistan, remain a bone of contention between countries.
- 19. Heavy challenges faced in terms of **innovation**, **expansion and regularisation of aspects related to fishing and trading**.
- 20. **Prevalence of antibiotic residues** in Indian fisheries stocks is a cause of worry for those who are looking at creating infrastructure to keep fishing sustainable, safe and healthy.

- Solution:
- 1. Adopting responsible and sustainable fishery practices: Experts have been suggesting that the country should stop taking pride in production capacity and **look at sustainable methods** to reach better commercial success with regard to the fishing industry.
- 2. Future growth: Experts opine that the fisheries sector should look at future growth, rather than just enjoying the catch with every passing year.
- 3. Establishing agro-aqua farms: Bringing together agriculture and aquaculture farms to create agro-aqua farms,
- 4. **Improving selling efforts: Improving selling efforts** inland should be taken care of.
- 5. **Spreadingfish quality literacy**: Spreading fish quality literacy among fishermen for improving quality which has been a cause for worry in the context of discovery of antibiotic residues in Indian fisheries stock.
- 6. Shifting of focus: Unless focus shifts to a comprehensive method of fishery, India stands the threat of losing its brownie points on this front.
- **7. Establishing Aqua shops and fishery estates** for better commercial success.
- 8. **Developing facilities: Facilities should be developed** for fish landing and handling at harvest and post-harvest stages.

# 3.6. MINERALS OF INDIA

**Definition of minerals:** Geologists define mineral as a "homogenous, naturally occurring substance with a definable internal structure." Minerals are found in varied forms in nature, ranging from the hardest diamond to the softest talc.

India has vast deposit of minerals. Our metallic ores are very rich and of a very high quality. They are sufficient for maintaining most of our key industries. The major minerals produced in India are Iron-ore, Bauxite, Mica, Coal and Petroleum. The principal minerals found in the country along with their estimated reserves/resources are given below:

#### 1. IRON-ORE:

• Presently, India is ranked third in Iron ore production. A large quantity of world's iron ore reserves is possessed by India. With the total resources of over 28.5 billion tonnes of hematite

(Fe203) and magnetite (Fe304), India is one of the leading producers as well as exporters of iron ore in the world.

- The resources of very high-grade ore are limited and are restricted mainly in the Bailadila sector of Chhattisgarh and to a lesser extent in Bellary-Hospet area of Karnataka and Barajamda sector in Jharkhand and Orissa.
- Haematite resources are located in Odisha, Jharkhand, Chhattisgarh, Karnataka, Goa, Maharashtra, Andhra Pradesh, Rajasthan, Tamil Nadu, Assam, Bihar, Maharashtra, Madhya Pradesh, Meghalaya, Rajasthan and Uttar Pradesh.
- India's 97% magnetite resources are located in its four states, namely, Karnataka- (73%) followed by Andhra Pradesh- (14%), Rajasthan and Tamil Nadu- (5% each). Assam, Bihar, Goa, Jharkhand, Kerala, Maharashtra, Meghalaya and Nagaland together account for the remaining 3% resources.

#### • State wise Iron Ore Deposit

- a) Odisha 5,930 million tonnes (33%) in Gurumahisini, Sulaipat, Badampahar (Mayurbhanj District), Barabil, Gurda, Kurband, Joruri, Kiriburu, Meghahataburu (largest iron ore mine of the world), (Keonjhar district), Mahagiri and Tomka ranges in Sukinda area (Cuttack district) and Bonai (Sundargarh district)
- b) **Jharkhand**, 4,597 million tons (26%)
- c) Chhattisgarh, 3,292 million tonnes (18%),
- d) **Karnataka** 2,159 million tonnes (12%) Bellary, Hospet and Sandur (Belary District), Babbudan Hills, Kudremukh, Gangamula (Chickmagalur District)
- e) **Goa** Goa-927 million tonnes (5%), Quepem, Satari, Ponda, and Bicholim
- f) Maharashtra Chandrapur, Ratnagiri and Bhandara districts
- g) AndhraPradesh Yerabati area(Karimnagar and Warangal districts), Veldurti (Kurnool district), Rajampet area(Cuddapah district), Obalapuram Siddapuram area (Anantapur district)
- h) **Rajasthan** Sikar, Udaipur and Jaipur districts.
- i) **Madhya Pradesh** Dhallirajhara (Durg district), Bailadila ( Bastar district)
- j) **Tamil Nadu** Tirthamalai hills (Salem districts), Yadapalli area and Killimalai area (Nilgiri district).

• Iron-ore contributes a major share the total value of metallic minerals that is produced in India. It is also a good foreign exchange earner next only to tea, sugar, jute and cotton.

#### 129

# 2. BAUXITE:

• India is the fifth largest producer of Bauxite in the world. Bauxite is the ore of aluminium. The total in situation reserves is 3.076 million tonnes. About 84 per cent of this reserve is of metallurgical grade. Important bauxite deposits are as follows:

- a. Bihar Lohardaga in Ranchi district, Palamou district
- b. Goa- Quepem and Konkan areas
- c. **Gujarat** Kutch district, Mewasa, Habardi, Nandana and Lamba in Jamnagar district
- d. Jammu and Kashmir- Raisi and Udampur areas
- e. Karnataka Belgaum district
- f. **Madhya Pradesh** Amarkantak area of Shahdol district by far the largest known deposit of bauxite in India.
- g. **Maharashtra** Kolhapur, Kaira, Thana, Kolaba, Ratnagiri, and Satara
- h. **Odisha** Kalahandi district, Koraput district, Sambalpur district. Odisha leads in raising bauxite in India.
- i. **Tamil Nadu** Nilgiri Hills, Palni Hills, Shevaroy Hills, Kollaimallai Hills region.
- j. Major reserves are concentrated in the East Coast Bauxite deposits of Orissa and Andhra Pradesh

# 3. MICA:

- India is one of the largest mica-producing countries of the world, ranked first in sheet mica production and accounts for about 60 per cent of global mica trade.
- Important mica-bearing pegmatite occurs in Andhra Pradesh, Jharkhand Bihar and Rajasthan.
- The in situ reserves of mica in Andhra Pradesh are 42,626 thousand tonnes, Bihar 12,938 tonnes, Jharkhand 1,494 tonnes and in Rajasthan 2,007 tonnes.
- The **Bihar** mica is of the very high quality. In India, the largest supply of Mica comes from Bihar. In Bihar the most important areas are Gaya and Hazaribagh in the 'mica belt' 150 km. long and 32 km. wide.
- It is used in electrical industry.
- Due to poor development of electrical industries at home, India exports most of the output contributing 75% of the world's requirements.

- 4. COAL:
- Generally the following varieties of coal are recognised
- I. Anthracite ranks highest among the coal
- II. Bituminous is a common commercial rank coal
- III. Lignite is inferior in calorific value
- IV. Peat practically has got no fuel value
- Coal is unevenly distributed in India.
- India is one of the principal producers of coal in the world.
- **Coal mining regions**: There are two types of formation of coal in India -
- a. Gondwana formation
- b. Tertiary formation
- Gondwana formation coal are found in the following states
- **Bihar** and **WestBengal** which produce the largest and good quantity of coal in India.
- Jharia, Giridih, Bokaro, Karanpura, etc. in **Bihar** and Raniganj in **West Bengal** are the most important mining centres.
- Bihar along supplies 44% of India's total output.
- Besides these areas, coal is found at Talcher in Odisha,
- Tendur and Singareni in Andhra Pradesh,
- Pench Valley and Umaria in Madhya Pradesh,
- Tertiary formation coal are found in the states of
- i. Meghalaya,
- ii. Assam,
- iii. Arunachal Pradesh,
- iv. Jammu and Kashmir



Fig: Coal reserves in India

- Important mines are found in the following regions:
- 1. **Damodar valley region**: Ranuganj, West Bengal (oldest field), Jharia, Bokaro, Daltonganj, Karanpura, Ramgarh of Bihar
- 2. **Son-Mahanadi-Brahmani Valley Region** Umaria, Singrauli,Korba of Madhya Pradesh and Talcher of Odisha
- 3. **Satpura Region** Mohpani, Pench Valley, Bisrampur, Lakhanpur, Jilmili, Chirimiri and Kasdo-Arand of Madhya Pradesh
- 4. **Wardha-Godavari-Indravati valley region** Wardha Valley, Chandrapur, Kamptee, Ballarpur of Maharashtra and Singareni, Kothagundem, Tandur and Yallandu of Andhra Pradesh
- 5. PETROLEUM:
- Petroleum is known as rock oil
- Oil fields of India are of two types:
- 1. On-shore fields –
- 2. Off-shore fields



Fig: Oil fields

1. On-shore fields are located in the following regions

# A. North-eastern India -

- I. Assam:
- Assam is the oldest oil producing state in India. The main oil bearing strata extend for a distance of 320 km in upper Assam along the Brahmaputra valley.
- Oilfields of Assam are relatively inaccessible and are distantly located from the main consuming areas. Oil from Assam is, therefore, refined mostly in the refineries located at Digboi, Guwahati, Bongaigaon, Barauni and Nomaligarh.
- Following are some of the important oilfields of Assam:
- i. The Digboi field:
- Located in the north-east of Tipam hills in Dibrugarh district of Upper Assam,
- Digboi is the oldest oil field of India.

132

- The oil bearing strata cover an area of about 13 sq km where oil is available at 400 to 2,000 metre depth.
- Over 800 oil wells have been drilled so far. Before the opening of the oil fields of west India, Digboi used to account for three-fourths of the total oil production of India.
- The most important centres are Digboi, Bappapang, Hassapang and Paintola. Most oil is sent to oil refinery at Digboi.
- ii. The Naharkatiya field:
- It is located at a distance of 32 km southwest of Digboi at the left bank of Burhi Dibing river.
- Out of the 60 successful wells drilled so far, 56 are producing oil while the remaining 4 are producing natural gas.
- The annual production is 2.5 million tonnes of oil and one million cubic metre natural gas.
- Oil from this area is sent to oil refineries at Noonamati in Assam (443 km) and Barauni in Bihar (724 km) through pipeline.
- iii. The Moran-Hugrijan field:
- It is located about 40 km south-west of Naharkatiya.
- Drilling has proved an oil bearing Barail horizon at a depth of 3,355 metre.
- Other fields have been discovered at Rudrasagar, Sibsagar, Lakwa, Galeki, Badarpur, Barholla and Anguri.
- II. Arunachal Pradesh -found in Tirap District.

Arunachal Pradesh has oil reserves at Manabhum, Kharsang and Charali.

- **III. Tripura** has promising oilfields discovered at Mamunbhanga, Baramura-Deotamura Subhang, Manu, Ampi Bazar, Amarpur-Dambura areas.
- **IV. Nagaland** Nagaland also has some oil bearing rock strata. Borholla on the border between Assam and Nagaland.

#### B. Western India

- I. Gujarat -
- Explorations by Oil and Natural Gas Commission (ONGC) have yielded valuable findings of oil bearing rock strata over an area of about 15,360 sq km around the Gulf of Khambhat.
- The main oil belt extends from Surat to Amreli.
- Kachchh, Vadodara, Bharuch, Surat, Ahmedabad, Kheda, Mehsana, etc. are the main producing districts

• Ankleshwer (Largest field in the Khambat Basin), Kalol, Nawagam, Lunej, Kosamba, Kathana, Wavel, Barkol, Dholka, Mehsana, Kadi, Ahmedabad and Sanand fields of these regions.

#### a. Ankleshwar:

- The first major oil-find came in 1958 with the discovery of Ankleshwar field located about 80 km south of Vadodara and nearly 160 km south of Khambhat.
- Ankleshwar anticline is about 20 km long and 4 km wide. Oil is available at depths varying from 1,000 to 1,200 metres.
- It has a capacity of 2.8 million tonnes per annum.

#### b. Khambhat or Lunej field:

• The oil and Natural Gas Commission drilled test wells in 1958 at Lunej near Ahmadabad and confirmed the occurrence of a commercially exploitable oil field.

#### c. Ahmedabad and Kalol field:

- It lies about 25 km north-west of Ahmedabad.
- This field and a part of Khambhat basin contain 'pools' of heavy crude trapped in chunks of coal.
- Nawgam, Kosamba, Mehsana, Sanand, Kathana, etc. are important producers.
- Oil has also been struck in Olkad, Dholka, Kadi, Asjol, Sandkhurd, Siswas, Nandesan, Bandrat, Sobhasan and Vadesar areas.
- d. Rajasthan:
- One of the largest on land oil discoveries was made in Banner district of Rajasthan in 2004. The oil block covers an area of approximately 5,000 sq km.

# C. Southern India –

Kaveri Basin ; oil fields are at Narimanam, Kovilappal etc.

- Off-shore fields –
- I. The Mumbai High Region the biggest oil field in India
- The greatest success achieved by the ONGC with respect to offshore surveys for oil was that of Mumbai High in 1974.
- It is located on the continental shelf off the coast of Maharashtra about 176 km north-west of Mumbai.
- The discovery of Mumbai High has revolutionised the oil production in India.

- The share of Mumbai High in the total oil production of India has shot up considerably.
- This area produced 85 lakh tonnes of oil in 1982 which rose to over 189 lakh tonnes or over 62 per cent of all India in 1991-92.

#### II. Bassein:

- Located to the south of Mumbai High, this is a recent discovery endowed with reserves which may prove to be higher than those of the Mumbai High.
- Huge reserves have been found at a depth of 1,900 metre.
- Production has started and is expected to pick up fast.

#### III. Aliabet:

- It is located at Aliabet Island in the Gulf of Khambhat about 45 km off Bhavnagar.
- Huge reserves have been found in this field.
- A sum of Rs. 400 crore has already been spent on this field. Commercial production is expected to start soon.

#### Probable Areas:

There are vast possibilities of finding oil from about one lakh sq km area of sedimentary rocks in different parts of the country. Some of the outstanding areas which hold possibilities of oil are:

- i. Jawalamukhi, Nurpur, Dharamsala and Bilaspur in Himachal Pradesh.
- ii. Ludhiana, Hoshiarpur and Dasua in Punjab,
- iii. The Gulf of Mannar off the Tirunelveli coast.
- iv. The off-shore area between Point Calimere and Jaffna peninsula
- v. Off-shore deep water area in Bay of Bengal between 12°N— 16°N latitudes and 84°E—86°E longitudes.
- vi. The marine delta region of the Mahanadi, Godavari, Krishna and Cauvery rivers.
- vii. Stretch of sea between South Bengal and Baleshwar coast.
- viii. Off-shore area of the Anadaman and Nicobar Islands.

#### 6 CHROMITE:

• Total in situ reserves of chromite are estimated at 114 million tonnes. The largest share (about 96 per cent) in the total geological resources is accounted by the **Cuttack district in Orissa**.

- Deposits of economic significance occur in Orissa, Karnataka, Maharashtra, Jharkhand, Madhya Pradesh, Chhattisgarh, Tamil Nadu and Manipur.
- 7. COPPER:
- a. The total **in situ reserves** of copper ore in the country are **712.5 million tonnes,** equivalent to 9.4 million tonnes of metal content.
- Major and important copper ore deposits are located in Singhbhum district (Jharkhand), Balaghat district (Madhya Pradesh) and Jhunjhunu and Alwar districts (Rajasthan).
- In addition, there are small copper ore deposits in Gujarat, Haryana, Karnataka, Andhra Pradesh, Uttar Pradesh, Sikkim, Meghalaya, Maharashtra and West Bengal.
- 8. GOLD:
- There are three important gold fields in the country, namely,
- a. Kolar Gold Fields, Kolar district, in Karnataka
- b. Hutti Gold Field in Raichur district in Karnataka) and
- c. Ramgiri Gold Field in Anantpur district (Andhra Pradesh).
- Total in situ reserves of gold ore are estimated at 22.4 million tonnes, with 116.50 tonnes of metal.
- 9. LEAD-ZINC:
- Lead-Zinc Resources are located in Rajasthan, West Bengal, Andhra Pradesh, Gujarat, Madhya Pradesh, Uttar Pradesh, Orissa, Maharashtra, Meghalaya, Tamil Nadu and Sikkim.

#### 10 MANGANESE:

- Next to Russia, India has the largest supply of Manganese. State wise distribution:
- a. Odisha tops the total resources with 44% share
- b. Karnataka 22%,
- c. Madhya Pradesh 13%,
- d. Maharashtra 8%,
- e. Andhra Pradesh 4% and
- f. Jharkhand & Goa 3% each.
- g. Rajasthan, Gujarat and West Bengal together shared about 3% of the total resources.

#### 11.TUNGSTEN:

• **The main reserves** are at Degana, Rajasthan. It also occurs in Maharashtra, Haryana, West Bengal and Andhra Pradesh.

### 12. DIAMOND:

- The main diamond bearing areas in India are the **Panna belt** in Madhya Pradesh, **Munimadugu-Banganapalle** conglomerate in Kurnool district, **Wajrakarur** Kimberlite pipe in Anantapur district and the gravels of Krishna river basin in Andhra Pradesh.
- The new kimberlite fields are discovered recently in Raichur-Gulbarga districts of Karnataka.

# 13.. DOLOMITE:

- Dolomite occurrences are widespread in almost all parts of the country.
- The major share of about 90 per cent reserves is distributed in the states of Madhya Pradesh, Chhattisgarh, Orissa, Gujarat, Karnataka, West Bengal, Uttar Pradesh and Maharashtra.

#### 14. GYPSUM:

• The production of gypsum is confined to Rajasthan, Tamil Nadu, Jammu and Kashmir, and Gujarat. Rajasthan is the main producer of gypsum followed by Jammu and Kashmir.

#### 15. GRAPHITE:

- The in situ reserves of graphite are 16 million tonnes.
- Orissa is the major producer of graphite.
- Almost the entire reserves of Tamil Nadu under the proved category are in **Ramanathapuram** district.
- Deposits of commercial importance are located in Andhra Pradesh, Jharkhand, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamil Nadu.

### 16. LIMESTONE:

- The total in situ reserves of limestone of all categories and grades are placed at 1, 69,941 million tonnes. The total conditional reserves have been estimated at 3,713 million tonnes.
- The major share of its production comes from Madhya Pradesh, Chhattisgarh, Andhra Pradesh, and Gujarat: Rajasthan, Karnataka, Tamil Nadu, Maharashtra, Himachal Pradesh, Orissa, Bihar, Uttaranchal and Uttar Pradesh. The remaining part comes from Assam, Haryana, Jammu and Kashmir, Ker and Meghalaya.

#### 17. MAGNETITE:

Major deposits of magnetite are found in Uttaranchal, Tamil Nadu and Rajasthan while minor deposits are in Jammu and Kashmir, Karnataka, Himachal Pradesh and Kerala.

#### 18. OTHER MINERALS:

- a. Other minerals occurring in significant quantities in India are betonies (Rajasthan, Gujarat, Jharkhand and Jammu and Kashmir),
- b. corundum (Karnataka, Andhra Pradesh, Rajasthan and Chhattisgarh),
- c. calcite (Andhra Pradesh, Rajasthan, Madhya Pradesh, Tamil Nadu, Haryana, Karnataka, Uttar Pradesh and Gujarat),
- d. fuller's earth (Rajasthan, Jharkhand, Bihar, Andhra Pradesh, Tamil Nadu, Maharashtra, West Bengal and Karnataka),
- e. garnet (Tamil Nadu, Orissa, Andhra Pradesh, Rajasthan and Kerala),
- f. pyrites (Jharkhand; Rajasthan, Karnataka, Himachal Pradesh and Andhra Pradesh),
- g. steatite (Rajasthan, Uttar Pradesh, Kerala, Maharashtra and Madhya Pradesh),
- h. wollastonite (Rajasthan and Gujarat),
- i. zircon (beach sand of Kerala, Tamil Nadu, Andhra Pradesh and Orissa) and
- j. Quartz and silica minerals are widespread and occur in nearly all states.
- k. Granite is mainly mined in Tamil Nadu, Karnataka, Andhra Pradesh and Rajasthan;
- I. marble in Rajasthan, Gujarat and Uttar Pradesh;
- m. Slate in Chhattisgarh, Madhya Pradesh. Haryana and Andhra Pradesh;
- n. Sandstone is found in Rajasthan.

# 3.7. POWER RESOURCES OF INDIA

**Electricity** has such a wide range of applications in today's world that, its per capita consumption is considered as an index of development.

It is the most convenient and versatile form of power and may be classified into four broad categories depending on its sources, namely:

- 1. **Thermal power** generated from coal, mineral oil, natural gas, to drive turbines to produce thermal power.
- 2. **Hydel power** generated from running water which drives hydro turbines to generate hydro electricity
- 3. Nuclear or Atomic power generated from Uranium and Thorium
- 4. The non- conventional sources of energy which includes
- i. Geothermal Energy
- ii. Solar Energy
- iii. Wind Energy
- iv. Tidal Energy
- v. Wave Energy
- vi. Bio Gas Energy
- vii. Urban Waste Energy
- **Hydro electricity** is one of the most common forms of power generation where power is generated from a renewable resource, water. It is considered as one of the most economic and non- polluting sources of energy.
- The potential for hydro-electric potential in terms of installed capacity in India is estimated to be about 148,700 MW out of which a capacity of 30,164 MW (20.3%) has been developed so far and 13,616 MW (9.2%) of capacity is under construction.
- India has a number of multi-purpose projects like the Bhakra Nangal, Damodar Valley Corporation, the Kopili Hydel Project etc.producing hydroelectric power.
- Disadvantages of Hydro power
- I. Building a dam
- a. The land that would otherwise be available for use,
- b. alters the landscape,
- c. affects the local community that would have lived and worked on the flooded land,
- d. alters the character of the river,
- e. prevents the free movement of fish.
- II. **Diverting a river affects** the nature of the countryside and does not lend itself to use on a large scale.
- III. **Permanent complete or partial blockage of a river** for energy conversion is adversely affected by variations in flow.
- IV. Building large-scale hydro power plants can be **polluting and** damaging to surrounding ecosystems.

- V. Changing the course of waterways can also have a **detrimenta**l effect on human communities, agriculture and ecosystems further downstream.
- VI. Hydro projects can also be **unreliable during prolonged droughts and dry seasons** when rivers dry up or reduce in volume.

# 1. THERMAL ELECTRICITY

- **Thermal electricity** is generated by using coal, petroleum and natural gas.
- The thermal power stations use non-renewable fossil fuels for generating electricity.
- There are over 310 thermal power plants in India.

# Major Thermal power plants are as follows:

# A. Mundra Thermal Power Station, Gujarat

- Mundra Thermal Power Station located in the Kutch district of Gujarat is currently the **second biggest operating thermal power** plant in India.
- It is a coal-fired power plant

### B. Talcher Super Thermal Power Station, Odisha

- Talcher Super Thermal Power Station or NTPC Talcher Kaniha, located in the Angul district of Odisha,
- It is a 3,000MW coal-fired power plant owned and operated by NTPC.
- The power station currently ranks as the **fourth largest** operational thermal power plant in India.

# C. Sipat Thermal Power Plant, Chhattisgarh

- The 2980MW Sipat Super Thermal Power Plant located at Sipat in the Bilaspur district of Chhattisgarh.
- It ranks as the **fifth largest thermal** power station in India.
- It is a coal-based power plant owned and operated by NTPC.

# D. NTPC Dadri, Uttar Pradesh

 NTPC Dadri or National Capital Power Station (NCPS) owned and operated by NTPC is located in the Gautam Budh Nagar district of Uttar Pradesh, about 48km from the Indian capital New Delhi.

#### E. NTPC Ramagundam, Andhra Pradesh

• NTPC's Ramagundam thermal power plant is located in the Karimnagar district of Andhra Pradesh

- It ranks as the seventh largest thermal power plant in India and the largest in south India.
- F. Korba Super Thermal Power Plant, Chattisgarh
- Korba Super Thermal Power Plant located in the Korba district of Chhattisgarh
- G. Rihand Thermal Power Station, Uttar Pradesh
- Rihand Thermal Power Station at Rihandnagar is located in the Sonebhadra district of Uttar Pradesh
- It ranks as the **ninth largest thermal** power plant in India.
- The coal-based power plant with an installed capacity of 2,500MW is owned and operated by NTPC.

# H. Jharsuguda Thermal Power Plant, Odisha

- Jharsuguda Thermal Power Plant, is in the Jharsuguda district of Odisha.
- It is currently the **tenth largest thermal** power plant operating in India.
- 2. NUCLEAR OR ATOMIC ENERGY:
- Nuclear or Atomic Energy It is obtained by altering the structure of atoms.
- When such an alteration is made, much energy is released in the form of heat and this is used to generate electric power.
- Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan are used for generating atomic or nuclear power. The Monazite sands of Kerala is also rich in Thorium.

# 3. NON-CONVENTIONAL SOURCES OF ENERGY:

- The growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. Increasing use of fossil fuels also causes serious environmental problems. Hence, there is a pressing need to use renewable energy sources like solar energy, wind, tide, biomass and energy from waste material.
- These are called **nonconventional energy sources**.
- India is blessed with an abundance of sunlight, water, wind and biomass.
- It has the largest programmes for the development of these renewable energy resources.

### The non-conventional energy sources are as follows:

# i. Geo Thermal Energy

- Geo thermal energy refers to the heat and electricity produced by using the heat from the interior of the Earth.
- Geothermal energy exists because, the Earth grows • progressively hotter with increasing depth. Where the geothermal gradient is high, high temperatures are found at shallow depths. Groundwater in such areas absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam. This steam is used to drive turbines and generate electricity. There are several hundred hot springs in India, which could be used to generate electricity. Two experimental projects have been set up in India to harness geothermal energy. One is located in the Parvati valley near Manikarn in Himachal Pradesh and the other is located in the Puga Valley, Ladakh.

#### ii. Solar Energy

- India is a tropical country. It has enormous possibilities of tapping solar energy.
- Photovoltaic technology converts sunlight directly into electricity.
- Solar energy is fast becoming popular in rural and remote areas.
- Some big solar power plants are being established in different parts of India which will minimise the dependence of rural households on firewood and dung cakes, which in turn will contribute to environmental conservation and adequate supply of manure in agriculture.

#### iii. Wind power

- India has great potential of wind power.
- The largest wind farm cluster is located in Tamil Nadu from **Nagarcoil to Madurai**. Apart from these, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms. Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.

### iv. Tidal Energy

- Oceanic tides can be used to generate electricity. Floodgate dams are built across inlets.
- During high tide water flows into the inlet and gets trapped when the gate is closed. After the tide falls outside the flood

gate, the water retained by the floodgate flows back to the sea via a pipe that carries it through a power-generating turbine.

- In India the Gulf of Khambhat, the Gulf of Kutch in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.
- v. Biogas
- Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas.
- Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene, dung cake and charcoal. Biogas plants are set up at municipal, cooperative and individual levels.
- The plants using cattle dung are known as 'Gobar gas plants' in rural India. These provide twin benefits to the farmer in the form of energy and improved quality of manure.

#### Conservation of Energy Resources :

Energy is a basic requirement for economic development. Every sector of the national economy – agriculture, industry, transport, commercial and domestic – needs inputs of energy. There is an urgent need to develop a sustainable path of energy development. Promotion of energy conservation and increased use of renewable energy sources are the twin planks of sustainable energy. After all, "energy saved is energy produced".

## 3.8. SUMMARY

The physical, economic and institutional framework taken together determines the pattern of land use of a country at any particular time. In other words, the existing land use pattern in different regions in India has been evolved as the result of the action and interaction of various factors taken together, such as the physical characteristics of land, the structure of resources like, capital and labour, available and the location of the region in relation to other aspects of economic development, e.g. those relating to transport as well as industry and trade. The area, for which data on the land use classification are available; is known as the reporting area.

Animal husbandry is an integral component of Indian agriculture supporting livelihood of more than two-thirds of the rural population. Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households. They are a natural capital, which can be easily reproduced to act as a living bank with offspring as interest, and an insurance against income shocks of crop failure and natural calamities. Following the sustained economic growth and rising domestic incomes, the demand for livestock products has increased tremendously.

India has one of the longest coastlines of the world at 7500km, large river system with untapped freshwater aquaculture, component of agriculture diversification to ensure secure livelihood, could addresses nutritional security concerns which are the potentials in the fisheries sector.

India is fortunate to have fairly rich and varied mineral resources. However, these are unevenly distributed. Broadly speaking, peninsular rocks contain most of the reserves of coal, metallic minerals, mica and many other non-metallic minerals. Sedimentary rocks on the western and eastern flanks of the peninsula, in Gujarat and Assam have most of the petroleum deposits. Rajasthan with the rock systems of the peninsula, has reserves of many non-ferrous minerals. The vast alluvial plains of north India are almost devoid of economic minerals. These variations exist largely because of the differences in the geological structure, processes and time involved in the formation of minerals.

# 3.9. CHECK YOUR PROGRESS/ EXERCISE

- 1. State whether the following statements are true or false.
- a. Hydel electricity is generated by using coal, petroleum and natural gas.
- b. Bihar is the third largest producer of inland fish (7.81%) in the country.
- c. Consistent degradation of shorelines and loss of coral reefs have been major problems faced by India
- d. There are over 310 thermal power plants in India
- e. Rihand Thermal Power Station, Odisha.
- f. Aquaculture is the backbone of Indian economy.
- g. The co-operative societies were most successful in the Anand District of Gujarat.
- h. India ranks first in juice production, accounting for 18.5 % of world production
- i. India is now the world's fifth largest egg producer and the eighteenth largest producer of broilers
- j. Livestock includes animal husbandry, dairy and fishery sectors
#### 2. Fill in the blanks

- a. The thermal power stations use \_\_\_\_\_\_ fossil fuels for generating electricity.
- b. Talcher Super Thermal Power Station is in \_\_\_\_\_
- c. There are two types of formation of coal in India Gondwana formation and \_\_\_\_\_\_\_\_formation.
- d. Bauxite is the ore of \_\_\_\_\_
- e. "Energy saved is energy \_\_\_\_\_".
- f. Cropped area in the year under consideration is called\_\_\_\_\_
- g. \_\_\_\_\_ energy refers to the heat and electricity produced by using the heat from the interior of the Earth.
- h. \_\_\_\_\_delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.
- i. The technology of White Revolution is based on an extensive system of \_\_\_\_\_\_ societies.
- j. The growing of different crops on a piece of land in a preplanned succession is called \_\_\_\_\_
- k. \_\_\_\_\_season starts with the onset of monsoons and continues till the beginning of winter
- I. Growing of two or more crops concurrently and blend together on the same piece of land without row arrangements is called \_\_\_\_\_\_Cropping

#### 3. Multiple choice questions.

I.Korba Super Thermal Power Plant is in

- a) Chhattisgarh
- b) Odisha
- c) West Bengal
- d) Maharashtra
- II. The Nellore District of Andhra Pradesh is known as the
- a) "Orange Capital of India"
- b) "Fashion Capital of India"
- c) "Power Capital of India"
- d) 'Shrimp Capital of India'
- III. The largest wind farm cluster is located in
- a) Tamil Nadu from Nagarcoil to Madurai
- b) West Bengal from Baj Baj to Andul
- c) Assam from Kamrup to Dibrugarh
- d) Odisha from Bhubaneswar to Puri

IV. The term "blue revolution" refers to the remarkable emergence of

- a) agriculture as an important and highly productive agricultural activity
- b) aquaculture as an important and highly productive agricultural activity
- c) milk production as an important and highly productive agricultural activity.
- d) irrigation as an important and highly productive agricultural activity

V. The two states which produce the largest and good quantity of coal in India are

- a) Bihar and Odisha
- b) West Bengal and Odisha
- c) Bihar and West Bengal
- d) West Bengal and Tamil Nadu

#### VI. Prof. Varghese Kuerin was the father of

- a) White Revolution in India.
- b) Blue Revolution in India
- c) Pink Revolution in India
- d) Green Revolution in India

VII. The land for which the data on classification of land-use is available is known as

- a) Reporting Land
- b) Non- Reporting Land

#### 4. Answer the Following Question

- 1. State five characteristics and problems of Indian Agriculture.
- 2. Write a short note on White Revolution.
- 3. What are the reasons behind the development of fisheries in India?
- 4. What is Blue Revolution?
- 5. What are the major minerals found in India? State distribution of any one mineral.
- 6. What are the major power resources of India?

# 3.10. ANSWERS TO THE SELF LEARNING QUESTIONS

- 1.a. False, Thermal electricity
- 1.b. True
- 1.c.True
- 1.d. True
- 1.e. False, Uttar Pradesh
- 1.f. False, Agriculture

1.g.True 1.h. False, Milk 1.i. True 1.j.True 2.a. non-renewable 2.b. Odisha 2.c. Tertiary 2.d. aluminium 2.e. produced 2.f. net sown area. 2.g. Geo thermal 2.h. Gangetic 2.i. co-operative 2.j. crop rotation 2.k. Kharif 2.I. Mixed 3.I.a. 3.II.d. 3. III. a. 3.IV. b. 3.V.c. 3.VI. a. 3.VII. a.

#### 3.11. TECHNICAL WORDS AND THEIR MEANING

- **alkaline**: containing sodium and/or potassium in excess of the amount needed to form feldspar with the available silica. an alkaline rock, for example, contains more than average amounts of potassium- and sodium-bearing minerals.
- **abundance** is a measure of how many fish are in a population or a fishing ground. see relative abundance and absolute abundance.
- **agriculture** the art or science of cultivate, cultivating the ground, including the harvesting of crops, and the rearing and management of livestock; tillage; husbandry; farming
- **cereal grains** plants of the grass family that produce grain (seeds) that provide human food. they include wheat, rice, barley, oats, corn (maize), rye and triticale.
- **deposition**: earth material of any type that has accumulated by some natural process and is large enough to invite exploration, such as a mineral or ore.
- **fishery** the activities leading to and resulting in the harvesting of fish. it may involve capture of wild fish or raising of fish through aquaculture. a fishery is characterised by the species caught, the fishing gear used, and the area of operation.

- fallow- idle crop land.
- **breed**: it is groups of animal that are result of breeding & selection have certain distinguishable characteristics
- **beef**: the meat of- cattle past calf stage.
- **mineral**: a naturally occurring inorganic substance having an orderly internal structure and characteristic chemical composition, crystal form, and physical properties.
- **mutton**: the meat of sheep & goat.

# 3.12. TASK

- 1. In a map of India locate the 6 nuclear power stations and find out the state in which they are located.
- 2. In a chart state the problems of Indian fisheries.
- 3. In a map of India point out
- (i) Iron ore region and ii. Coal field

# 3.13. REFERENCES FOR FURTHER STUDY

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149

# INDUSTRIES, TRANSPORT AND COMMUNICATION AND TRADE

After going through this chapter you will be able to understand the following features.

#### **Unit Structure**

- 4.1 Objectives
- 4.2 Subject- Discussion
- 4.3 Role of Industries in Economic development
- 4.4 Factors of Industrial Location
- 4.5 Major Industrial Regions of India
- 4.6 Iron and Steel Industry of India
- 4.7 Cotton Textile Industry of India
- 4.8 Engineering Industry of India
- 4.9 Special Economic Zone
- 4.10 Need ,Importance and development of Transportation
- 4.11 Road Transport
- 4.12 Rail Transport
- 4.13 Water Transport
- 4.14 Air transport
- 4.15 Comparison between different modes of Transportation
- 4.16 Cost of Transportation
- 4.17 Communication
- 4.18 Problems of transport
- 4.19 Internal Trade
- 4.20 International Trade
- 4.21 Balance of Trade
- 4.22 Summary
- 4.23 Check your Progress/ Exercise
- 4.24 Answers to the self learning questions.
- 4.25 Task
- 4.26 Glossary
- 4.27 References for further study

# **4.1 OBJECTIVES**

By the end of this unit you will be able to -

- understand the economic importance of industries.
- know India's Industrial Regions.
- examine the advantages and disadvantages of industrial location.
- know the problems of industries.
- understand the comparison of location of various industries
- understand the cost of production
- know about the special economic zones of India
- know the meaning and importance of transportation
- know India's road and rail, water and air routes.
- examine the advantages and disadvantages of types of transportation.
- know the communication system in the world.
- comparison of various modes of transportation
- cost of transportation
- International and internal trade
- Balance of trade

#### **4.2 INTRODUCTION**

In this chapter you are going to study **factors for industrial location** as well as the major industries of India, its problems and solution. Moreover, we will learn about Special Economic Zone (SEZ) also. **Special Economic Zone (SEZ)** is a special geographical region which has completely different laws when compared to other regions.

In this chapter we will also study the **major transport routes** i.e. land, water and air routes of the world. The advantages and disadvantages of different modes of transportation have also been discussed in the following chapter. Transportation helps both the production, distribution as well as consumption processes.

On the other hand **Communication** is the process of receiving and sending messages between two persons or agencies located at different places whereas **Trade** involves exchange of goods among people living in different regions or countries of the world.

## **4.3 SUBJECT DISCUSSION**

It is observed that a combination of various factors like land, raw materials, government policy, water, transportation etc are important for the establishment of **industry**.

**Transportation** and **communication** is a tertiary economic activity. With the advancement of human society, the need of transportation and communication has increased. It is observed that transportation is highly developed in the advanced countries. In short carrying of commodities or people from one place to means transportation.

**Communication** is the process of receiving and sending messages between two persons or agencies located at different places. Radio and Television are the means of mass-communication which provide information, news and entertainment to the people spread over vast distances. Telephone and telegraph services bring the people closer to one another. Their contribution in promoting business and **trade** is incalculable.

**Trade** involves exchange of goods among people living in different regions or countries of the world. It plays a vital role in accelerating the progress of agriculture and industry of a country.

# 4.4. ROLE OF INDUSTRIES IN ECONOMIC DEVELOPMENT OF A COUNTRY

Industries play a vital role in the development of a country's economy. India is rich in natural resources, such as minerals, forests, fisheries, there is abundant supply of commercial crops, such as sugar\_cane, raw cotton, raw jute, tobacco, oil seeds, etc.; the country is fairly rich in power resources, such as coal, hydroelectricity, and atomic energy. Also India is rich in human resources and there is wide market available in the country. All these factors have accelerated the development industries in India.

 With the development of industry, <u>modernisation in the</u> <u>agricultural field</u> has been possible. Initially in countries, like India where agriculture is traditional and backward the cost of production is high and the productivity is low. To increase productivity and modernise agriculture we need chemical fertilisers, pesticide and tractors, pump sets respectively. These are all industrial products and without all these, agricultural development and modernisation is not possible.

- Industrialisation has played a <u>pivotal role in the field of science</u> <u>and technology</u>. The industrial enterprises conduct research and develop new products. Ethanol in the form of bio-fuel is an example of industrial development. The progress in atomic science, satellite communication etc. are the sign of progress in this field.
- <u>Urbanisation follows industrialisation</u>. Growth of transport and communication in a particular area are the effects of industrialisation.
- In large scale industries where surplus is very high, <u>profits can</u> <u>be re-invested</u> for expansion and development. So, industries help in capital formation.
- By applying advanced technology, <u>division of labour and</u> <u>scientific management</u> in the industries, production and employment increase rapidly. This again results in the economic growth and capital formation.
- Industrialisation plays a vital <u>role in the promotion of trade</u>. The developed countries gain in trade compared to the developing ones. The underdeveloped countries export primary products and import industrial products. Agricultural products command lower prices but their demand is elastic where as industrial products command higher values but their demand is inelastic.
- Industrialisation plays an important role in resource utilisation.
- Industrial development helps in the fast growth of national and per capita income.
- With the progress of industries a country can produce high quality goods and services and <u>attainhigher standard of living</u>.
- Industries are either manufacture or service oriented, and provide employment opportunities. Poverty and unemployment can be eradicated with the fast growth in the industrial sector which enables employment of surplus labour from the villages.
- Industrialisation is needed to provide for a country's security. This consideration becomes all the more critical when some international crisis develops. In such situation, dependence of foreign sources for defence materials is a risky affair. It is only through industrial development the national objective of selfreliance in defence materials can be achieved.

- A number of <u>public and private companies operate in an</u> <u>industry</u>, which may manufacture the same goods or provide the same services, but <u>follow different strategies and guidelines</u> to operate their businesses. Most <u>public and private limited</u> <u>companies sell shares</u> in order to generate funds to start up or run their business, and these shareholders are the legal owners of a company. Generally, the ones who own the majority of shares have more <u>influence on decision making of a company</u>.
- When in an industry the <u>rights of minority shareholders are</u> <u>eliminated</u> or differentiated from the majority shareholders, <u>it</u> <u>creates a management problem</u>, which then results in operational <u>inefficiency of the company</u>.
- Industrialisation initiates a proper balance of rights of majority and minority shareholders for the welfare of a company.

# 4.5 FACTORS INFLUENCING INDUSTRIAL LOCATION

There are several factors which pull the industry to a particular place. Some of the major factors influencing location are discussed below:

According to <u>Jones and Darkenwald</u> the manufacturer must have easy access to raw materials power, labour, capital and markets. Access to these essentials of manufacturing depends largely upon well developed transportation facilities. These six essentials are the basic factors in the development of modern manufacturing. The significance of each of them varies with time, from industry to industry and from region to region.

#### 1. Availability of raw materials:

- In determining the location of an industry, <u>nearness to sources</u> of raw material is of vital importance. Nearness to the sources of raw materials would reduce the cost of production of the industry. For most of the major industries, the cost of raw materials forms the bulk of the total cost. Therefore, most of the agro-based and forest-based industries are located in the vicinity of the sources of raw material supply.
- For those industries in which unprocessed commodities are primary input, however, the source and characteristics of the raw materials upon which they are based are really important.

- When raw materials are bulky, undergo great weight loss in the processing, or are highly perishable attract the industries that process them. For example Copper smelting and iron ore beneficiation are weight reducing industries are localised by their ore supplies. Pulp, paper, and saw mills are logically found in areas within or accessible to timber.
- Fruit and vegetable conning in California and Florida and Orange juice concentration and freezing are various examples of raw material orientation.
- The reason is simple it is cheaper and easier to transport to market a refined or stabilized product than one filled with waste material or subject to spoilage and loss.
- <u>Multiple raw materials</u> might dictate an intermediate plant location. Least cost may be determined not by a single raw material input but by the spatially differing costs of accumulating several inputs.
- <u>But now a days raw materials have become much less</u> important as a location factor for a number of reasons :

a) as transport has developed and special handling facilities have become available, the movement of raw material has become easier.

b) industries have become more complex, fewer and fewer firms are now only material based.

c) technological improvements have intensified the use of materials so that there is less waste in manufacture.

d) other factors like markets and labour have gained importance so raw materials have declined relatively.

#### 2. Availability of Labour:

- <u>Adequate supply of cheap and skilled labour</u> is necessary for an industry and hence an important determinant of industrial location.
- Three major considerations: <u>price</u>, <u>skill</u> and <u>amount</u> of <u>labour</u> may be determinant singly or in combination.
- The attraction of an industry <u>towards labour centres</u> depends on the ratio of labour cost to the total cost of production which

<u>Weber calls 'Labour cost of Index'</u>. The availability of skilled workers in the interior parts of Bombay region was one of the factors responsible for the initial concentration of cotton textile industry in the region.

#### 3. Proximity to Markets:

- Goods are produced to supply a market demand. Therefore access to markets, its size, nature and distribution are important factors which the entrepreneur must take into consideration.
- Industries producing perishable or bulky commodities which cannot be transported over long distance are generally located in close proximity to markets.
- Industries located near the markets could be able to reduce the costs of transport in distributing the finished product as in the case of bread and bakery, ice, tins, cans manufacturing, etc.
- Accessibility of markets is more important in the case of industries manufacturing consumer goods rather than producer goods.

#### 4. Transport Facilities:

- Transport facilities, generally, influence the location of industry.
- The transportation with its three modes, i.e., water, road, and rail collectively plays an important role.
- The junction points of water-ways, roadways and railways become humming centres of industrial activity.
- Further, the modes and rates of transport and transport policy of Government considerably affect the location of industrial units.
- The heavy concentration of cotton textile industry in Bombay has been due to the cheap and excellent transportation network both in regard to raw materials and markets.

#### 5. Power:

- <u>Another factor</u> influencing the location of an industry is the availability of <u>cheap power</u>.
- Water, wind, coal, gas, oil and electricity are the chief sources of power.

- Both water and wind power was widely sought at sources of power supply before the invention of steam engine.
- During the nineteenth century, nearness to coal-fields became the principal locating influence on the setting up of new industries, particularly, for heavy industries.
- With the introduction of other sources of power like electricity, gas, oil, etc. the power factor became more flexible leading to dispersal and decentralization of industries.

#### 6. Site and Services:

- Existence of <u>public utility services</u>, <u>cheapness of the value of the</u> <u>site</u>, <u>amenities</u> attached to a particular site like level of ground, the nature of vegetation and location of allied activities influence the location of an industry to a certain extent.
- The government has classified some areas as <u>backward areas</u> where the entrepreneurs would be granted various incentives like subsidies, or provision of finance at concessional rate, or supply of power a cheaper rates and provision of education and training facilities. Some entrepreneurs induced by such incentives may come forward to locate their units in such areas.

## 7. Finance:

- Finance is required for the setting up of an industry, for its running, and also at the time of its expansion.
- The availability of capital at cheap rates of interests and in adequate amount is a dominating factor influencing industrial location.
- For instance, a review of locational history of Indian cotton textile industry indicates that concentration of the industry in and around Bombay in the early days was mainly due to the presence of rich and enterprising Parsi and Bhatia merchants, who supplied vast financial resources.

#### 8. Natural and Climatic Considerations:

• Natural and climatic considerations include the level of ground, topography of a region, water facilities, drainage facilities, disposal of waste products, etc. These factors sometimes influence the location of industries.

• For instance, in the case of cotton textile industry, humid climate provides an added advantage since the frequency of yarn breakage is low. The humid climate of Bombay in India and Manchester in Britain offered great scope for the development of cotton textile industry in those centres.

#### 9. Personal Factors:

- In deciding location of industrial units, sometimes an entrepreneur may have personal preferences and prejudices against certain localities.
- For instance, Mr. Ford started to manufacture motor cars in Detroit simply because it was his home-town. In such cases, personal factor dominates other considerations. However, this kind of domination is rare.

#### 10. Strategic Considerations:

- In modern times, strategic considerations are playing a vital role in determining industrial location.
- During war-time a safe location is assuming special significance. This is because in times of war the main targets of air attacks would be armament and ammunition factories and industries supplying other commodities which are required for war. T
- he Russian experience during the Second World War provides and interesting example.

#### 11. External Economies:

- External economies also exert considerable influence on the location of industries.
- External economies arise due to the growth of specialized subsidiary activities when a particular industry is mainly localized at a particular centre with port and shipping facilities.
- External economies could also be enjoyed when a large number of industrial units in the same industry were located in close proximity to one another.

#### 12. Miscellaneous Factors:

- <u>Historical incidents</u> also play a dominating role in determining the location of industries in certain cases.
- The development of cotton-textile industry in Lancashire provides an interesting example for this.
- Further, the <u>size of an industrial unit</u> would also have much influence in choosing location. This is because the size of industrial units depends upon the radius of the circle within which they can profitably distribute their goods and upon the density of population living within the circle.

# 4.6. MAJOR INDUSTRIAL REGIONS OF INDIA

Following are the 8 major industrial regions of India

- 1. Mumbai-Pune Industrial Region
- 2.Hugli Industrial Region.
- 3. Bangalore-Tamil Nadu Industrial Region
- 4. Gujarat Industrial Region
- 5. Chotanagpur Industrial Region
- 6. Vishakhapatnam-Guntur Industrial Region
- 7. Gurgaon-Delhi-Meerut Industrial Region
- 8. Kolfam-Thiruvananthapuram Industrial Region.



## Fig: Industrial Regions of India

#### 4.6.1 <u>Mumbai-Pune Industrial Region</u>:

• This region owes <u>its origin</u> to the British rule in India. It extends from Thane to Pune and in adjoining districts of Nasik and Sholapur. In and around this region, industries have grown at a rapid pace in Kolaba, Ahmednagar, Satara, Sangli and Jalgaon districts also.

• When the island-site was obtained for construction of Mumbai port in 1774 the seeds of its growth were sown. The opening of the

first railway track of 34 kms between Mumbai and Thane in 1853, opening of the Bhor and Thai Ghats respectively to Pune and Nasik and that of Suez Canal in 1869 led to the development of Mumbai.

• The growth of this industrial region is fully connected with the growth of cotton textile industry in India. As coal was not available nearby, hydel power was developed in Western Ghats. Cotton was cultivated in the black cotton soil area of the Narmada and Tapi basins.

• Cheap labour-force came from the hinterland, the port facilities for export-import and communication links with the peninsular hinterland made Mumbai the 'Cottonopolis of India'. With the development of cotton textile industry, the chemical industry developed too.

• Opening of the Mumbai High petroleum field and erection of nuclear energy plants added additional magnetic force to this region. Now the industrial centres have developed, from Mumbai to Kurla, Kolaba, Thane, Ghatkopar, Ville Parle, Jogeshwari, Andheri, Thane, Bhandup, Kalyan, Pimpri, Pune, Nashik, Manmad, Solapur, Ahmednagar, Satara and Sangli.

• In addition to cotton textile and chemical industries, engineering goods, leather, oil refineries; petrochemicals, synthetic and plastic goods, chemicals, drugs, fertilizers, electricals, electronics, software, ship-building, transport and food industries have also developed here.

• The partition of the country in 1947 adversely affected this region because 81% of the total irrigated cotton area growing long staple cotton went to Pakistan. Mumbai, the nucleus of this industrial region, is facing the current limitation of space for the expansion of the industry. Dispersal of industries is essential to bring about decongestion.

## • 4.6.2. The Hugli Industrial Region:

• The Hugli Industrial Region <u>located in West Bengal</u>, extends as a narrow belt running along the river Hugli for a distance of about 100 km from Bansbaria and Naihati in the north to Birlanagar in the south. Industries have also developed in Midnapur district in the west. The river Hugli offered the best site for the development of an inland river port as nucleus for the development of Hugli industrial region. • <u>Kolkata-Haora</u> forms the nucleus of this region. It is very wellconnected by the Ganga and its tributaries. The <u>rich hinterland</u> of Ganga-Brahmaputra plains plays an important role in this regard. Moreover the navigable rivers, roads and the railways provided <u>subsequent links</u> to the great benefit of Kolkata port.

• The <u>discovery of coal and iron ore</u> in Chotanagpur plateau, tea plantations in Assam and northern parts of West Bengal and the processing of deltaic Bengal's jute led to the industrial development in this region.

• <u>Cheap labour</u> could be found easily from the thickly populated states of Orissa, Bihar, Jharkhand and eastern part of U.P. Kolkata, having been designated capital city of the British India (1773-1912) attracted large scale British investment of capital.

• Establishment of first jute mill at Rishra in 1855 ushered in the era of modem industrial clustering in this region. A chain of jute mills and other factories could be established on either side of Hugli River with the help of Damodar valley coal. The port site was best-suited for export of raw materials to England and import of finished goods from that country.

• Kolkata's industries have established by drawing in the raw materials from adjoining regions and distributing the finished goods to consuming points. Thus, the role of transport and communication network has been as important as the favourable locational factors in the growth of this region. By 1921, Kolkata-Hugli region was responsible for two-thirds of factory employment in India.

• The region faced the problem of shortage of raw jute just after the partition of India in 1947 as most of the jute-growing areas went to East Pakistan (now Bangladesh). The problem was solved by gradually increasing home production of jute. Cotton textile industry also grew along with jute industry.

• Paper, engineering, textile machinery, electrical, chemical, pharmaceuticals, fertilizers and petrochemical industries have also developed in this region. Factory of the Hindustan Motors Limited at Konnagar and locomotive-diesel engine factory at Chittaranjan are landmarks of this region.

• Location of petroleum refinery at Haldia has facilitated the development of a variety of industries. The major centres of this industrial region are Kolkata, Haora, Haldia, Serampur, Rishra,

Shibpur, Naihati, Kakinara, Shamnagar, Titagarh, Sodepur, Budge Budge, Birlanagar, Bansbaria, Belgurriah, Triveni, Hugli, Belur, etc.

#### Problem in this region

• <u>Old and obsolate machinery</u>: The industrial growth of this region has slowed down as compared to the other regions. There are several reasons for this sluggish growth but decline in jute industry is said to be one of the main reasons. Most of the jute mills, cotton textiles and the engineering industries of this region were developed during the British rule in India. The machineries are old dated and obsolete.

• <u>Lack of modern touch in the production</u>: There is lack of modern touch in the production to match the changes in the consumer preferences.

• <u>Decadence of the Kolkata Port</u>: Most of the industries of this region are port based. <u>Alarming rate of silting</u> of the Hugli River is a very serious problem. The depth of water in the channel from bay head to Kolkata docks must be kept at 9.2 metres for big ocean ships to come in. Dredging out of the silt rapidly filling up the water channel was very costly and not a permanent solution to save the life of Kolkata port.

- Labour unrest.
- Paucity of capital.

# Solutions to the above stated problem of this belt are as follows:

- The construction of Farakka barrage about 300 kms upstream on Ganga and flushing of the channel are the only possible answers.
- The construction of Haldia port in the lower reaches of Hugli to the south of Kolkata is another landmark in relieving the great pressure of cargo ships on the port of Kolkata.
- Change of old machineries with the introduction of modern ones.
- Increase of power supply.
- Reduction of export duty of jute goods.
- Arrangements of Public Awareness Programmes regarding the use of eco-friendly nature of jute products.

#### 4.6.3. Bangalore-Tamil Nadu Industrial Region:

- <u>Spread in two states of Karnataka and Tamil Nadu</u>, this region experienced the fastest industrial growth in the postindependence era. Till 1960, industries were confined to Bangalore district of Karnataka and Salem and Madurai districts of Tamil Nadu. But now they have spread over all the districts of Tamil Nadu except Viluppuram.
- This region has flourished in a cotton-growing tract and hence is dominated by the cotton-textile industry. In fact cotton textile industry was the first to take roots in this region. But it has large number of silk-manufacturing units, sugar mills, leather industry, chemicals, rail wagons, diesel engines, radio, light engineering goods, rubber goods, medicines, aluminium, cement, glass, paper, cigarette, match box and machine tools, etc.
- This region is away from the main coal-producing areas of the country but <u>cheap hydroelectric power is available from Mettur,</u> <u>Sivasamudram, Papanasam, Pykara and Sharavati dams</u>.
- Cheap skilled local labour.
- Proximity to vast local market.
- <u>Good climate</u> has also favoured the concentration of industries in this region.
- <u>Coimbatore</u> has grown rapidly mainly owing to its industrial growth based on Pykara power, local cotton, coffee mills, tanneries, oil presses and cement works. Coimbatore <u>is known</u> <u>as Manchester of Tamilnadu</u> because of its large-scale cotton textile industry.
- The <u>establishment of public sector units at Bangalore</u> like Hindustan Aeronautics, Hindustan Machine Tools, Indian Telephone Industry and Bharat Electronics etc. has further pushed up the growth of industries in the region.
- Madurai is known for its cotton textiles.
- Visvesvarayya Iron and Steel Works is located at Bhadravati.
- The other important centres of this region are Sivakasi, Tiruchirapalli, Madukottai, Mettur, Mysore and Mandya. Petroleum refinery at Chennai and Narimanam and iron and steel plant at Salem are recent developments.

#### 4.6.4. Gujarat Industrial Region:

• As the nucleus of this <u>region lies between Ahmedabad and</u> <u>Vadodara</u> it is also known as Ahmedabad-Vadodara industrial region. This region extends up to Valsad and Surat in the south and Jamnagar in the west. The region corresponds to the cotton growing tracts of the Gujarat plains and the development of this region is associated with the location of textile industry since 1860s.

- With the decline of cotton textile industry in Mumbai this region became an important textile region.
- Mumbai has the disadvantage of paying double freight charges for first bringing the raw cotton from the peninsular hinterland and then despatching the finished products to inland consuming points in India. But Ahmedabad is nearer the sources of raw material as well as the marketing centres of the Ganga and Satlui plains.
- <u>Availability of cheap land, cheap skilled labour</u> and other advantages helped the cotton textile industry to develop. This major industrial region of the country, mainly consisting of cotton textile industry, is expanding at a much faster rate in providing a greater factory employment.
- The discovery and production of oil at a number of places in the Gulf of Khambhat area led to the establishment of petrochemical industries around Ankleshwar, Vadodara and Jamnagar. Petroleum refineries at Koyali and Jamnagar provide necessary raw materials for the proper growth of petrochemical industries.
- <u>The Kandla port</u>, which was developed immediately after independence, provides the basic infrastructure for imports and exports and helps in rapid growth of industries in this region. The region can now boast of diversified industries.
- Besides textiles (cotton, silk and synthetic fibres) and petrochemical industries, <u>other industries</u> are heavy and basic chemicals, dyes, pesticides, engineering, diesel engines, textile machinery, pharmaceuticals, dairy products and food processing. The main industrial centres of this region are Ahmedabad, Vadodara, Bharuch, Koyali, Anand, Khera, Surendranagar, Surat, Jamnagar, Rajkot and Valsad. The region may become more important in the years to come.

#### 4.6.5. Chotanagpur Industrial Region:

- This region is located on the Chotanagpur plateau and extends over Jharkhand, Northern Orissa and Western part of West Bengal. The discovery of coal in Damodar Valley and iron ore in the Jharkhand-Orissa mineral belt is responsible for the birth and growth of this region. As both are found in close proximity, the region is known as the 'Ruhr of India'.
- Besides raw materials, <u>power is available from the dam sites</u> in the Damodar Valley and the <u>thermal power stations based on</u> <u>the local coal</u>.

- This region is surrounded by highly populated states of Jharkhand, Bihar, Orissa and West Bengal which provide <u>cheap</u> <u>labour.</u>
- <u>Well developed transport and communication</u> facilitated industrial development in this area. A good road network complemented by an efficient network of broad gauge double track electrified railways facilitates the movement of raw materials, finished products and workers.
- <u>Government patronage</u> has helped in acquiring many tracks of land for further industrial development.
- Although Tropic of Cancer passes through this region the <u>climate is cool</u> owing to higher elevation compared to the neighbouring plains.
- <u>Abundant water supply</u> from the Damodar and Subarnarekha river system.
- <u>The Kolkata region provides a large market for the goods</u> <u>produced in the Chotanagpur region</u>. It also provides the port facility to the region. It has the advantages for developing ferrous metal industries. The Tata Iron and Steel Company at Jamshedpur, Indian Iron Steel Co., at Bumpur-Kulti, Hindustan Steel Limited at Durgapur, Rourkela and Bokaro are the important steel plants located in this region.
- Heavy engineering, machine tools, fertilizers, cement, paper, locomotives and heavy electricals are some of the other important industries in this region. Important nodal centres of this region are Ranchi, Dhanbad, Chaibasa, Sindri, Hazaribagh, Jamshedpur, Daltonganj, Garwa and Japla.

#### 4.6.6. Vishakhapatnam-Guntur Industrial Region:

- This industrial region extends from Vishakhapatnam district in the north-eastern part of Andhra Pradesh to Kurnool and Prakasham districts in the south-east and covers most of the coastal Andhra Pradesh. The industrial development of this region mainly depends upon Vishakhapatnam and Machilipatnam ports.
- Developed agriculture and rich mineral resources in the hinterlands of these ports provide solid base to the industrial growth in this region. Coal fields of the Godavari basin are the main source of energy. Hindustan Shipyard Ltd. set up at Vishakhapatnam, set up in 1941 is the main focus.
- Petroleum refinery at Vishakhapatnam facilitated the growth of several petrochemical industries. Vishakhapatnam has the most modern iron and steel plant which have the distinction of being the only plant in India having coastal location. It uses high quality iron ore from Bailadila in Chhattisgarh.

 One lead-zinc smelter is functioning in Guntur district. The other industries of this region include sugar, textiles, paper, fertilizers, cement, aluminium and light engineering. The important industrial centres of this region are Vishakhapatnam, Vijaywada, Vijaynagar, Rajahmundry, Kurnool, Elum and Guntur. Recent discovery of natural gas in Krishna- Godavari basin is likely to provide much needed energy and help in accelerated growth of this industrial region.

#### 4.6.7. Gurgaon-Delhi-Meerut Industrial Region:

- Although this region has developed after independence it is one of the fastest growing regions of India consisting of two industrial belts adjoining Delhi. One belt extends over Agra-Mathura-Meerut and Saharanpur in U.P. and the other between Faridabad-Gurgaon-Ambala in Haryana.
- The industries in this region are light and market oriented as they are located far away from the mineral and power resources. The region owes its development and growth to hydro-electricity from Bhakra-Nangal complex and thermal power from Harduaganj, Faridabad and Panipat.
- Sugar, agricultural implements, vanaspati, textile, glass, chemicals, engineering, paper, electronics and cycle are some of the important industries of this region. Software industry is a recent addition, Agra and its environs have glass industry. Mathura has an oil refinery with its petro-chemical complex. One oil refinery has been set up at Panipat also.
- This will go a long way to boost the industrial growth of this region. Gurgaon has Maruti car factory as well as one unit of the IDPL. Faridabad has a number of engineering and electronic industries. Ghaziabad is a large-centre of agro-industries. Saharanpur and Yamunanagar have paper mills. Modinagar, Sonipat, Panipat and Ballabhgarh are other important industrial nodes of this region.

#### 4.6.8. Kollam-Thiruvananthapuram Industrial Region:

- This is comparatively small industrial region and spreads over Thiruvananthapuram, Kollam, Alwaye, Emakulam and Allapuzha districts of south Kerala. The region is located far away from the mineral belt of the country as a result of which the industrial scene here is dominated by agricultural products processing and market oriented light industries.
- Plantation agriculture and hydroelectricity provide the industrial base to this region. The main industries are textiles, sugar, rubber, match box, glass, chemical fertilizers, food and fish processing, paper, coconut coir products, aluminium and

cement. Oil refinery set up in 1966 at Kochi provides solid base to petrochemical industries. Important industrial centres are Kollam, Thiruvananthapuram, Alluva, Kochi, Alappuzha and Punalur.

Besides the above mentioned eight major industrial regions, India has <u>13 minor industrial regions and 15 industrial districts</u>. Their names are mentioned below:

#### 4.6.9 Minor Industrial Regions:

- 1. Ambala-Amritsar in Haryana-Punjab.
- 2. Saharanpur-Muzaffamagar-Bijnaur in Uttar Pradesh.
- 3. Indore-Dewas-Ujjain in Madhya Pradesh.
- 4. Jaipur-Ajmer in Rajasthan.
- 5. Kolhapur-South Kannada in Maharashtra-Karnataka.
- 6. Northern Malabar in Kerala.
- 7. Middle Malabar in Kerala.
- 8. Adilabad-Nizamabad in Andhra Pradesh.
- 9. Allahabad-Varanasi-Mirzapur in Uttar Pradesh.
- 10. Bhojpur-Munger in Bihar.
- 11. Durg-Raipur in Chhattisgarh.
- 12. Bilaspur-Korba in Chhattisgarh.
- 13. Brahmaputra Valley in Assam.

# 4.7. MAJOR INDUSTRIES OF INDIA

#### 4.7.1 IRON STEEL INDUSTRY

#### Introduction:

India being a developing country, the basic need of Indian economy today is rapid industrialization, for her economic upliftment. As important industries like Railway locomotive, Ship Building, Heavy and Light Machine, Construction, etc. depend on the availability of iron and steel, iron and steel industry accelerates industrialization and is, therefore, called the backbone of all industries.

As on 2013, with crude steel production of 81.2 million metric tons, India is ranked as the fourth largest steel producing country in the world. It is estimated that India would produce 86 million metric tons of steel in 2015.

#### **\*** Raw materials needed for Iron and Steel Industry

- The raw materials for Iron & Steel Industry includes <u>iron ore,</u> <u>fuels (coal, coke), limestone, dolomite, silica, refractories,</u> <u>manganese, nickel, tungsten, etc.</u> are also used.
- The industry is, therefore, located either near coal producing areas or iron-ore producing areas.
- <u>Iron ores are found</u> all over the country. For the production of one tonne of iron and steel, generally 1.5 tons of iron-ore, 0.45 tons of coke, 0.5 tonnes of limestone and 0.5 tonnes of manganese, nickel, dolomite, etc. and nearly 60 tonnes of water are required.
- Iron ores and ancillary materials like manganese and mica are found in very large quantities in many parts of India, particularly in Jharkhand, Odisha and Chotanagpur. We are equally rich in the supply of coking coal required for steel manufacture.
- <u>Large amount of water</u> is required to cool the smelt iron, which is heated to very high temperatures with the help of coal. The factories are generally located near rivers or lakes and near coal or iron-ore mines.
- Other factors affecting the location of the steel plants are:
- 1. Availability of cheap labour near the steel plant,
- 2. Good communication
- 3. <u>Market</u>
- 4. <u>Ports</u>
- 5. <u>Huge amount of capital</u> is required for setting up of iron and steel plant.
- \* The major Iron Steel Plants in India are as follows:

#### 1. Tata Iron and Steel Company (TISCO):

Tata Steel Limited (Formerly Tata Iron and Steel Company – TISCO) is the oldest iron and steel centre of India. This Iron & Steel Industry, a private sector enterprise, started on August 25, 1907 by a Parsi businessman Jamshedji Tata at Sakchi village in Singhbhum district of Bihar (now Jharkhand). Later on, it was renamed as Jamshedpur after Jamshedji. It started producing pig iron in 1911 and steel in 1912. Tata Steel has a very large productive capacity for finished steel per year. Today, Tata Steel is a multi-national steel maker and has operations in more than 25 countries including India, China, United Kingdom, Singapore, Thailand, etc. In 2007, Tata Steel acquired the UK based steel maker – Corus. Based on 2013 data, <u>Tata Steel is the eleventh largest steel producing company in the world</u>. Its global crude capacity is little over 25 million tonnes.

The plant initially had capacity of producing 1.21 million tonnes of pig iron and 1.1 million tonnes of steel per annum. This capacity has been enhanced to 3.9 million tonnes of pig iron, 2 million tonnes of ingot steel and 3 million tonnes of saleable steel. Currently it produces about 3 million tonnes of saleable steel.

The facilities available to this centre are as follows:

- (i) <u>High grade haematite iron ore</u> is available from Noamundi mines of Singhbhum in Jharkhand and Gurumahisani mines of Mayurbhanj in Orissa. These mines are located at a distance of 75-100 km from Jamshedpur.
- (ii) <u>Coal is available from Jharia and Raniganj</u> coal mines located 160 to 200 km from Jamshedpur.
- (iii) <u>Manganese</u> comes from Joda mines of Kendujhar district in Orissa.
- (iv) <u>Dolomite</u>, <u>limestone</u> and <u>fire</u> clay used as flux material are available from Sundargarh district of Orissa.
- (v) Kolkata, located at a distance of 250 km, provides port facilities and its industrialised <u>hinterland</u> provides market for the products.
- (vi) <u>Sufficient water</u> for cooling purposes is obtained from Subarnarekha River. In addition to this, the storage dam on Kharkai River also provides water.
- (vii) <u>Jamshedpur is well connected</u> with Kolkata, Mumbai and Chennai by road and rail and enjoys good transport facilities.
- (viii) Densely populated regions of Jharkhand, Bihar and Orissa provide <u>cheap labour</u>. Major part of labour is drawn from tribal areas of Chota Nagpur plateau.

The shortage of space in Jamshedpur and some other allied factors persuaded TISCO to locate a second steelworks at Gopalpur in Orissa, about 170 kms south-east of Bhubaneswar.

The favourable factors are as follows:

- coastal location,
- proximity to a rich iron ore belt
- availability of sparsely settled land for the project
- a nearby source of fresh water in the form of a rivulet
- proximity to the trunk rail line and a national highway
- the presence of a minor deep water port which could be expanded.

Tata Steel acquired land near Gopalpur to set up a shore based steel plant in 1997 <u>but shelved the project later</u> due to slow pace of development of Gopalpur port and a resistance movement by local people. Consequently the Tata Steel decided to build a six million tonne plant at Dubari.

#### Dubari Steelworks:

The infrastructure included development of the Dhamra port and a railway line between Dhamra and Bhadrakh. The project is a part of Tata Steel's plan to reach 15 million tonne capacity by 2010. This plant will use the latest technology and will be cost competitive with the most efficient steel plants in the world.

#### 2. Indian Iron and Steel Company (IISCO):

Three plants at Kulti, Hirapur and Bumpur in West Bengal which were set up in 1864, 1908 and 1937 respectively have been merged together and are known as Indian Iron and Steel Company (IISCO).

- It was brought under government control and management in July 1972.
- The three plants are linked by Kolkata-Asansol railway line.
- Hirapur plant produces pig iron which is sent to Kulti for making steel.
- The rolling mills are located at Bumpur.

The following advantages have facilitated the growth of IISCO in this region:

- (i) <u>Iron ore is available</u> from Guna mines in Singhbhum district of Jharkhand located at a distance of 285 km. Some iron ore is also obtained from Mayurbhanj area of Orissa.
- (ii) It used to <u>receive coal from Jharia</u>, located at a distance of 137 km but now the power from the Damodar Valley Corporation is extensively used.
- (iii) <u>Dolomite and limestone</u> are obtained from Sundargarh district of Orissa which is 327 km away. Limestone is also available from Gangpur and Paraghat areas of Orissa.
- (iv) <u>Rail and road links</u> connect it to Kolkata which is just 200 km away.
- (v) <u>Cheap labour</u> is readily available from the neighbouring areas.

IISCO has annual capacity of producing 10 lakh tonnes of steel. Currently it produces over 4 lakh tonnes of pig iron, more than 3.5 lakh tonnes of crude steel and around 3.8 lakh tonnes of saleable steel.

#### 3. The Visweswaraya Iron and Steel Ltd:

Located at Bhadravati on the banks of river Bhadravati in Shimoga district of Karnataka The Visweswaraya Iron and Steel Ltd was established as Mysore Iron and Steel Company (MISCO) in 1923. This plant was brought under state control in 1962 and was renamed as Visveswaraya Iron and Steel Ltd. after the name of great engineer Dr. Visweswaraya. This plant has got a capacity of 1.38 lakh tonnes of steel. There are plans to raise its capacity to two lakh tonnes.

#### This centre enjoys the following advantages.

- (i) Bhadravati valley is 13 km wide as a result of which <u>enough land</u> <u>is available.</u>
- (ii) <u>High grade haematite</u> iron ore is brought from Kemmangundi mines in Chikmaglur which is just 40 km away.
- (iii) At the time of the setting up of the plant in 1923 the charcoal obtained from the forest-wood was used for smelting because coal was not available. Now it <u>uses hydroelectric power</u> <u>obtained from Sharavati Power Project.</u>

- (iv) <u>Limestone</u> is available from Bhundiguda just 25 km away.
- (v) Shimoga and Chitradurga supply <u>manganes</u>e. These areas are just 50 km away.
- (vi) <u>Dolomite</u> and <u>chromites</u> are also available within a radius of 45-50 km.
- (vii) It lies on the main Bim-Shimoga <u>railway line</u> and makes use of <u>railway facilities</u>.

In order to increase the production of iron and steel, the Government of India established The Hindustan Steel Limited in public sector. Consequently, three plants under the public sector, i.e. Bhilai, Rourkela and Durgapur came into operation during the Second Five Year Plan. Capacity of each plant was fixed at 10 lakh tonnes of steel which was expanded during the Third Five Year Plan and a proposal of setting up a steel plant at Bokaro was also made.

#### 4. Bhilai:

In 1957 with the technical and financial support of the then Soviet Union Bhilai iron and steel centre was set up in Durg district of Chhattisgarh. It started production in 1959. Its initial capacity was 10 lakh tonnes which has been raised to 52 lakh tonnes.

As Durg happened to be a backward area the purpose of setting this plant was to bring prosperity to this area. This plant produced 41.87 lakh tonnes of crude steel, 38.32 lakh tonnes of saleable steel and 2.43 lakh tonnes of pig iron in 1996- 97.

#### It enjoys following geographical advantages:

- (i) It procures <u>rich haematite iron</u> ore from Dalli-Rajhara range which is 80 km south of Bhilai.
- (ii) <u>Coa</u>l is obtained from Korba and Kargali fields of Chhattisgarh located at 225 km away. Bokaro and Jharia (720 km) also supply coal.
- (iii) Limestone comes from Nandini mines hardly 24 km away.
- (iv) Bhandara of Maharashtra and Balaghat of Madhya Pradesh supply manganese.
- (v) The Korba Thermal Power station is the main source of power.
- (vi) It is connected with Kolkata-Nagpur railway line.
- (vii) Dolomite comes from Bilaspur.
- (viii) <u>Cheap labour</u> is available from the nearby areas.

#### 5. Rourkela:

Plant of Hindustan Steel Limited at Rourkela is situated in the Sundargarh district of Orissa It was set up with the help of the then West German firm, Krupps and Demang, during the Second Five Year Plan (West Germany and East Germany have united to form one country now). It became operative in 1959. It produced 12.40 lakh tonnes of crude steel, 11.80 lakh tonnes of saleable steel and 0.54 lakh tonnes of pig iron in 1996-97.

# This plant has the following facilities for its successful operation:

- (i) This plant uses iron ore obtained from Sundargarh and Keonjhar districts. These iron ore sources are located within a distance of 77 km from the site of the plant.
- (ii) Coal is obtained from Jharia coalfields located at a distance of 225 km and Talcher, located at a distance of 169 km.
- (iii) Hydro-electric power is obtained from Hirakud Power Project, located at a distance of 150 km.
- (iv) The plant receives manganese from Barajmda, dolomite from Baradwar and limestone from Pumapani. These materials are located within a radius of 222 km in Orissa.
- (v) It is located on the main Nagpur-Kolkata railway line and enjoys facilities of railway transport.
- (vi) Kolkata provides the port facilities and its hinterland serves as market.

#### 6. Durgapur:

Durgapur Steel Plant of The Hindustan Steel Ltd. is located at Durgapur in Bardhaman district of West Bengal. It was set up in 1959 with the help of the United Kingdom. The production started in 1962. It has a total capacity of 35 lakh tonnes. It produced 12.45 lakh tonnes of crude steel, 10.93 lakh tonnes of saleable steel and 1.14 lakh tonnes of saleable pig iron in 1996-97.

The Alloy Steel Plant at Durgapur has a capacity to produce 1.6 lakh tonnes of ingots steel which has been expanded to 2. lakh tonnes of crude steel. The following geographical factors favour its location and growth:

- (i) Iron ore comes from Bolani mines. Mayurbhanj also supplies iron ore. These areas are located within a radius of 320 km.
- (ii) Coal comes from Jharia and Raniganj.
- (iii) Limestone is obtained from Birmitrapur in Sundargarh and manganese from Keonjhar district of Orissa.
- (iv) Dolomite is supplied by Birmitrapur.
- (v) Hydroelectricity is available from Damodar Valley Corporation.
- (vi) Plenty of water is available from Durgapur Barrage built across Damodar River.
- (vii) The Kolkata-Asansol railway line links it with other parts of the country.
- (viii) Cheap labour is readily available from the surrounding areas.

#### 7. Bokaro:

The Bokaro Steel Ltd, a new public sector company, was formed in 1964 to erect a steel plant with the collaboration of the erstwhile Soviet Union at Bokaro near the confluence of the Bokaro and Damodar rivers in Hazaribagh district of Jharkhand. It is the second plant set up with the Soviet help. It started production in 1972. Its initial capacity was 10 lakh tonnes which was raised to 40 lakh tonnes.

There are plans to raise its capacity to 100 lakh tonnes making it the largest iron and steel making centre in India. It produced 36.44 lakh tonnes of crude steel, 30.46 lakh tonnes of saleable steel and 2.6 lakh tonnes of pig iron in 1996-97.

The following geographical factors have facilitated the development of this plant:

- (i) It receives iron ore from Kiriburu mine in Orissa.
- (ii) Coal is obtained from Jharia coalfields located at a distance of 65 km.
- (iii) Limestone comes from Palamu district of Jharkhand.
- (iv) Hydroelectricity is obtained from Damodar Valley Corporation.
- (v) Kolkata is just 300 km from here and provides port facilities.

<u>Three more steel plants</u> were planned during the <u>Fourth Five-</u> <u>Year</u> Plan in order to meet the growing requirement of steel.

These plants are located at :

- Salem in Tamil Nadu
- Vishakhapatnam in Andhra Pradesh
- Vijayanagar in Karnataka.

#### 8. The Salem Steel Plant:

The plant has been set up at Salem in the Salem district of Tamil Nadu.

176

This plant has the following facilities for its successful operation :

- 1. Advantage of rich iron ore and limestone, which is readily available in the adjoining areas.
- 2. It also enjoys the facilities of cheap power, charcoal and vast market.
- 3. The iron ore available here has low sulphur and phosphorus content and is suitable for producing special grade iron and steel.

<u>The plant started commercial production</u> in 1982. Its capacity was 32 thousand tonnes of stainless steel sheets in the beginning. This capacity was doubled in 1991 with the addition of another rolling mill. This capacity was further raised to 80 thousand tonnes of saleable steel in 1995-96.

The Salem Steel Plant is a major producer of world class stainless steel today. It is also in a position to export stainless steel to some of the advanced countries such as the USA, Mexico, Australia and some countries of South-East Asia.

In order to cater to the growing demand for coinage of the Indian Government Mints, the management had also set up a banking facility in 1993 with a capacity of 3,000 tonnes per annum. It also commissioned a hot rolling facility in November, 1995 which has state-of-the-art technology with high level of automation. This plant produced 48 thousand tonnes of saleable steel in 1995-96.

#### 9. Vijayanagar Steel Plant:

This plant has been set up at Tomagal near Hospet in Bellary district of Karnataka. It has the installed capacity of 30 lakh tonnes. The production of mild steel will be its special feature. This plant enjoys the following facilities:

- (i) Iron ore is obtained from Hospet region located in close proximity.
- (ii) Coal comes from Kanhan valley in Chhattisgarh and Singareni coal fields in Andhra Pradesh.
- (iii) Good quality limestone and dolomite is available at a distance of about 200 km.
- (iv) Water and power requirements are met by the Tungabhadra hydel project located at a distance of about 36 km from the plant.

#### 10. Vishakhapatnam Steel Plant (VSP):

This integrated steel plant is the <u>first shore based steel plant</u> in the country and has a unique location on the sea port. Although the foundation stone of the plant was laid in 1972, the construction work could not start in the real sense till February 1982 when Rashtriya Ispat Nigam Limited was incorporated as a public sector company to implement the construction of the plant.

The project has been completed in two stages:

(a) the first stage was completed by March 1992 and

(b) second and final stage by July 1992.

This is the most sophisticated modem integrated steel plant in the country. Though the production commenced in 1991-92, 1993-94 was the first full year of integrated operation.

In the year 1997-98, this plant produced 32.14 lakh tonnes of hot metal, 25.4 lakh tonnes of liquid steel, 22.5 lakh tonnes of saleable steel and 7.7 lakh tonnes of pig iron. It is a major export oriented steel plant and takes full advantage of its coastal location. In 1995-96, it exported 10.23 lakh tonnes of iron and steel worth Rs.702 crore, mainly to China and south-east Asian countries.

Currently holding 67th rank among 80 largest steel makers on the globe, as certified by the Brussels- based International Iron and Steel Institute, VSP is smooth-sailing towards reaching its goal of turning into a 'world class company in steel industry'; as a result of the effective turnaround strategy adopted by its management for the last couple of years.

Buoyed by such a strong performance the VSP now intends to accelerate on the expansion trajectory. Presently it is the second

largest producer of iron and steel in the country and the present annual capacity of three million tonnes of liquid steel can be raised to 5 million by 2006-07 and to 10 million tonnes by 2010.

The plant management intends to go in for massive up gradation of technology and skill of its personnel which will be required if the natural gas from the Krishna-Godavari basin is to be utilised to cut down cost. Import of metallurgical coal from Australia can be reduced considerably if proper arrangements for utilising natural gas from Krishna- Godavari basin are made. The natural gas requirement is placed at one billion cubic metres (BCM) a year and negotiations are in progress with the Reliance Group in this connection.

#### The plant has the following advantages:

- (i) The coastal location facilitates import of coal and export of iron and steel.
- (ii) It is well connected to coal fields of Damodar valley in Jharkhand. Metallurgical coal is imported from Australia which meets about 70 per cent power requirements.
- (iii) The plant has a bright future with respect to its energy requirements because there are plans to replace coal imported from Australia by natural gas from the Krishna-Godavari basin.
- (iv) High quality rich iron ore deposits are available in the Bailadila area of Chhattisgarh.
- (v) Most of the requirements of limestone, dolomite and manganese are met by supplies from Chhattisgarh; Madhya Pradesh and Orissa.

#### 11. Daitari Steel Plant:

A decision to set another steel plant at <u>Daitari near Paradwip</u> in Orissa has been taken.

#### 12. Tata Steel Kalinganagar:

Tata Steel will set up a six million plant at Kalinganagar in Orissa with an investment of Rs. 15,000 crore. Land for the project has been acquired and detailed project report has been prepared. The first phase of 3 million tonnes capacity will be completed in three and a half years. With this project, Tata Steel is going to build a port at Dharma in Orissa in a joint venture with Larsen & Toubro 179

to handle 3,00,000 tonne ship. A Rs. 1,500 crore investment has been earmarked for the port to facilitate import of coal and export of finished goods.

# 13. Dolvi Steel Plant:

A new steel plant is fast coming up at Dolvi in Ratnagiri district in Maharashtra. Being set up by the Ispat Industries Ltd., the plant will use new technology in steel making. The 3 million tonnes annual capacity hot rolled coil plant will be one of the most modern plants in the world. It will require less space, less energy, high labour productivity and will involve less cost of production. Producing thin strips will be a special quality of this plant.

# 14. Posco Steel, Paradwip:

Pohang Steel Company (Posco) of Korea has entered into a Memorandum of Understand (MoU) with Orissa Government for setting up a steel plant at Paradwip with a total investment of Rs. 51,000 crore.

# International Trade:

India is both an importer and an exporter of iron and steel. However, our imports are much higher than the exports.

# Iron and Steel Production

India produced about 5 crore and 84 lakh m ton crude steel, 62.11 lakh m ton pig iron, 5.72 crore m ton finished steel

# **4.7.2 COTTON TEXTILE INDUSTRY**

Introduction: Cotton Textile Industry is one of the important and the largest single industry in India. About 70% of the cotton produced in India is used for making textiles. It accounts for a large portion of the total industrial output in the country, nearly 16% of the total industrial output each year. At present cotton textile industry accounts for nearly **13%** of the total **foreign income** of the country and engage about 3 crore 50 lakh people. India is one of the important cotton-manufacturing countries of the world. Both shortstaple and long-staple cotton is grown in the country.

# **Production and Trade:**

India is the largest producer and exporter of cotton textile products. India ranks 1<sup>st</sup> in production as well as export of cotton goods. India exports cotton textiles to the countries like Russia, U.K., Australia, Sri Lanka, Iran, Germany, Belgium, Italy, etc. In 2008-09 India produced nearly 290 crore kg, of cotton yarn and 2690 crore square metre of cotton cloths. In 1985 per capita consumption of cotton cloth in India was 15.35 metre. In 2008-09 it increased to 39 metre. (Ref: Economic Survey 2009-10 page A 24)

# **\*** History, Growth and Development

• The production of cotton both by hand spinning and weaving has been practiced in India from time immemorial. While the factory production of cotton goods dates back to the middle of the 19th century it used to be only a cottage industry in the ancient and the medieval times. India was famous worldwide for the production <u>of muslin, a very fine variety of cotton cloth, calicos, chintz and other different varieties of fine cotton</u> cloth.

• Initially, the British did not encourage the development of the indigenous cotton textile industry. They exported raw cotton to their mills in Manchester and Liverpool and brought back the finished products to be sold in India.

• The cotton textile industry in Indian was initiated with the establishment of the <u>first cotton textile factory at Ghusuri near</u> <u>Kolkata in 1818</u>. However, it was closed down very soon due to the shortage of raw material.

• Actual development of the industry had been taking place since <u>1859 with the establishment of cotton mill at Mumbai which is</u> located in the cotton growing region of Western India.

# \* Types of cotton Textile Industry

There are two types cotton textile industry

- a. Mill Mills are of three types :
- Spinning mill
- Weaving mill
- Composite mill
- b. Loom Looms are two types :
- Handloom
- Power loom
# The factors helped in the development of this industry in India are as follows:

- It is a tropical country and cotton is the most comfortable fabric for a hot and humid climate.
- Large quantity of cotton is grown in India in the black soil region. The cotton growing regions are Maharashtra, Gujarat, Karnataka, Tamil Nadu, etc. Gujarat ranks 1<sup>st</sup> position in cotton cultivation in India.
- Cotton as a raw material is light weight and non-perishable.
- When Cotton is spun to yarn or textile there is hardly any weight loss. Therefore, proximity to raw material site is not essential.
- As a result <u>other factors</u> become more important in industrial location i.e.
- 1. Nearness to market
- 2. Nearness to water body (for dyeing, bleaching)
- 3. Energy to run power looms and textile machines
- 4. Cheap labour supply.
- 5. Abundant skilled labour required for this industry is easily available in this country
- 6. Availability of capital/finance

• In some areas the people who were producing cotton textiles for generations, transferred the skill from one generation to the other and in this process perfected their skills.

## \* Raw materials

The cotton textile industry requires <u>raw cotton</u> as principal raw material and chemicals like <u>caustic soda</u>, <u>dyes</u>, <u>arrowroot or</u> <u>starch</u>, etc. for its production.

## ✤ <u>Distribution:</u>

Cotton textile centres of India are distributed in **four regions**:

- 1. Western Region,
- 2. Southern Region,
- 3. Northern Region and
- 4. Eastern Region.

## 1. Western Region:

Gujarat and Maharashtra are most advanced states of this region. Mumbai in Maharashtra and Ahmedabad in Gujarat are two principal centres of this region. Ahmedabad is known as the 'Manchester of India'. The other centres include Nagpur, Pune, Sholapur, Jalgaon in Maharashtra and Surat, Bharuch, Vadodara, Bhavanagar, Rajkot in Gujarat.

### Factors for the growth of the industry in this region are:

- Black soil region of Gujarat and Maharashtra is the best cotton growing region of India. So local raw cotton from Gujarat and Maharashtra is easily available.
- Availability of cheap hydel power from Bhira, Bhibpuri, Khopali, Koyna of Maharashtra and Ukai, Kadana of Gujarat produced in Western Ghats.
- Three most important ports are located in this region. So, port facilities of Mumbai, Kandla and Jawaharlal Nehru are available here which favours the import of raw material and machineries and export of finished cotton products. Raw long staple cotton is imported through the port Kandla and Mumbai from Egypt and other foreign countries
- This region being adjacent to the Arabian Sea enjoys the humid climate required for spinning of the yarn.
- Large capital invested by Parsi and Bhatia businessmen. Moreover, Mumbai is also the economic capital of India so, money is affluent.
- Locally available cheap and skilled labour from Konkan, Satara, Sholapur etc.
- Well-knit transport system, through Western and Central railways and many high ways.
- Good demand for cotton garments and cotton textile products of this region both inside and outside India.

We will now discuss about **the important cotton producing centres** of this region. They are as follows:

#### 1. AHMEDABAD

The black soil of Western India is favourable for cotton cultivation. Ahmedabad has witnessed the growth of large number of Cotton Textile Industries in recent years. <u>The reasons are cited below</u> :

- Ahmedabad, situated on the bank of the river Sabarmati, gets water from it which is again used for dying thread.
- It is near the Black-Cotton soil region—so it gets raw materials from the neighbouring region.
- The temperate climate of this region is suitable for spinning fine thread.
- Long staple cotton can be imported through Mumbai and Kandla ports from foreign countries like Egypt and Sudan
- It gets power from the Ahmedabad thermal power station.
- It gets cheap and skilled labour from the neighbouring region which is densely populated.
- It gets capital from the Gujarati, Sindhi and Bhatra people who are rich and are ready to invest huge sum of money.
- The products have a wide market both inside and outside India.
- The city is well-connected by means of roadways and railways with other important parts of the country.
- Cotton textile research institutes, situated here, carry researches for the better production and development of the industries.

Ahmedabad is called the "<u>Manchester of India"</u> because it has similarity with the famous cotton textile centre of Manchester, Great Britain. Let us find out the <u>reason for why is it called so</u>.

Manchester is an industrially developed region in U.K. and is particularly developed in cotton industries. Climate condition of Manchester is temperate and is suitable for spinning fine thread. The water of the river Mershey is good for dying thread. Just like Manchester, Ahmedabad in India, is situated on the bank of Sabarmati River. Its water is good for dying thread. Climatic condition is also suitable for spinning fine thread.

#### 2. <u>MUMBAI</u>

Mumbai is the leading centre of cotton textile industry in India. <u>Factors responsible for the growth of cotton textile industries</u> in Mumbai are as follows:

- <u>Raw materials</u>: The nearby Black-Cotton soil region produces raw cotton. Mumbai gets raw materials from the neighbouring region and is the collecting centre of raw cotton which is imported.
- <u>Port Facilities</u>: Mumbai port has excellent harbour facilities for importing long staple cotton and machinery to meet the requirements of the mill and export of the finished cotton products to abroad.
- <u>Humid Climate</u>: Mumbai situated in the western coastal region of the Konkan in Maharashtra has humid climate essential for spinning and weaving.
- <u>Soft Water</u>: Abundant supplies of soft water are available for dyeing and bleaching.
- Labour: There are supplies of skilled and skilled workers in large number.
- <u>Supply of Electricity</u>: It has a favourable position to get cheap hydel power and electricity at affordable rate.
- <u>Chemicals</u>: Chemicals required for cotton textile industries are easily available from the well developed chemical industries in Mumbai-Pune industrial belt.
- <u>Market</u>: There is a good market for the yarn and cotton fabrics both in home and foreign countries.
- <u>Transport</u>: Both Rail and road transport system are well developed.

## 2. Southern Region:

In South India cotton mills are located in the states of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. Important centres are Madurai, Salem, Tiruchirapalli Chennai, Guntur, Mysore, Pondicherry etc. **Coimbatore** is the largest cotton textile centre of this region. It is known as the "**Manchester of South India**".

# The <u>factors for the development of cotton textile industry in</u> <u>this region are:</u>

- Supply of local raw cotton
- Supply of cheap hydel power
- Good transportation network
- Port facility through the ports of Kochi, Chennai, Tuticorin etc.
- Locally available cheap labour
- Warm and humid climate
- Dense population of the region providing large market.

# 3. Northern Region:

The region includes the states of Uttar Pradesh, Delhi, Punjab, Haryana and Rajasthan. The principal centres are Kanpur, Delhi, Amritsar, Ludhiana, Agra etc.

The factors for the development of the industry in this region are:

- Long staple cotton is produced here
- Cotton is grown with the help of irrigation
- High demand for cotton goods in north India
- Good transportation system
- Plenty of local cheap labour.
- 4. Eastern Region:

This region includes the states of West Bengal, Bihar, Orissa and Assam. Maximum mills are located at Kolkata, Sodepur, Belgharia, Shyamnagar, Ghusuri, Salkia, Sreerampur, Maurigram etc.

The advantages for the growth of this industry are as follows:

- Nearness to the Kolkata port
- Coal of Raniganj mine
- Cheap labour of West Bengal, Odisha, Jharkhand and Bihar
- Good transportation system,
- Humid climate and
- High demand for cotton goods.

# **Problems of the Cotton Textile Industry**

The cotton Textile Industry has confronted with a number of problems among which the more important are as follows:

## 185

- The production and supply of raw cotton is highly erratic.
- Long staple cotton is not well grown in many parts of India and is imported from Egypt and Sudan.
- Many of the factories are old, the plants and machinery employed in many of our textile mills are obsolete. Moreover, they were put to intensive use and have considerably deteriorated. All these have resulted into low productivity.
- High cost of advanced machinery is an unavoidable hindrance for the procurement of new machinery. For this reason, the much-needed replacement had to be deferred for many years.
- The high cost of production is also effectively retarding the growth of this important industry. Prices of other raw materials like dyes, chemicals and starch are soaring every year.
- Irregularity of coal supply also affects the industry badly.
- There is competition from synthetic fibres like polyester, etc.
- There is competition in the International Market from Bangladesh, Japan, China, and Britain, etc.
- Great difficulties are being experienced by mill-owners in obtaining the capital needed for modernization.
- Managerial inefficiency leads to strikes and lockouts of the factories.
- Localisation of cotton growing region.

#### Solutions

Plenty of problems are there in the field of cotton textile industry in India. <u>The following are the solutions:</u>

- The plant and machinery have to be replaced at an early date.
- Introduction of the more up-to-date and modernized machinery is very urgent and has to be done without any delay in the interest of producers and consumers alike.
- Easy loan facility should be extended to the industries intending to modernize their plant and machinery.
- Assured availability of raw-materials, labour, and power would ensure steady supply.
- Economies of large-scale production should be encouraged to keep down the prices of finished products.

#### **Prospects of Cotton Textile Industry in India**

Modern day human beings are very conscious about health a hygiene. So, demand for cotton goods is increasing rapidly. To increase the production of cotton and to solve other problems related to the industry "**National Textile Corporation**" and "**Cotton Goods Export Development Organisation**" have been set up by the Government of India.

#### 4.7.3 ENGINEERING INDUSTRIES

**Engineering Industry** is a largely diversified industry, which produces a wide range of machineries and its associated steel products. It also **known as Mechanical or Public Work Industry.** Productions include engines, machines, cars, agricultural or mining machineries. Primarily it is based upon metal works, but now a days other materials such as PVC, plastics, nylon rubber are commonly used.

#### Growth and Development

This sector of the industry **developed only after independence**. Before that the country totally depended on imports.

#### **Raw materials**

Iron and Steel is by far the most important metals used in the engineering industry, although non-ferrous metals especially aluminium and copper are also required for certain industries.

#### **Characteristics of engineering industries**

- 1. Iron and steel and other metals are the basic requirements of engineering industries.
- 2. Manufacturing leads to value addition in the product.
- 3. Electricity is used in small quantities.
- 4. There is an increase in the volume of manufactured products, some of which need careful handling, and, therefore the cost of transportation is high.
- 5. Many engineering industries need assembling.
- 6. Raw materials and power are used in less quantity and the cost of production is much higher and therefore market is the prime factor in the location of these industries.

#### **Classification of engineering industries:**

The engineering industries may classified into two categories based on the amount of raw material used, shape and size of the products, number of labours engaged and the amount of capital invested.

## 1. Heavy Engineering Industry

## 2. Light Engineering Industry

The engineering industries include the following **major type** of manufacturers:

- 1. Machine tools, for cutting, grinding, rolling, drilling, welding etc. which help in the manufacture of tools and machinery for motor vehicles, locomotives, ship building, air craft etc.
- 2. Industrial machinery, such textile and mining machinery
- 3. Agricultural machinery such as tractors, combines, harrowimplements
- 4. Locomotives, air crafts, ships, motor vehicles etc.
- 5. Electrical instruments and tools, printing machines and domestic equipment.

# 4.8. A Special Economic Zone (SEZ)

# 4.8.1 Definition:

• **Special Economic Zone (SEZ)** is a special geographical region which has economic laws that are more liberal than a country's domestic economic laws. **India has specific laws for its SEZs**.

# ✤ The category 'SEZ' covers a broad range of more specific zone types, that includes:

- Free Trade Zones (FTZ),
- Export processing zones (EPZ),
- Free Zones (FZ),
- Industrial Estates (IE),
- Free ports,
- Urban Enterprise Zones and others.

✤ Usually the goal of a structure is to increase foreign direct investment by foreign investors, typically an international business or a Multi National Corporation (MNC).

## Category of SEZ

1. "Free trading and warehousing "is a special category sez with a focus on trading and warehousing. The **objective** of such zone is to create trade related infrastructure to facilitate import and export and import of goods and services with freedom to carry out trade transactions in free currency.

2."**Special Economic Zone for multi-product" means** a Special Economic Zone where Units may be set up for manufacture of two or more goods in a sector or goods falling in two or more sectors or for trading and warehousing or rendering of two or more services in a sector or rendering of services falling in two or more Sector.

3."**Special Economic Zone for specific sector**" means a Special Economic Zone meant exclusively for one or more products in a sector or one or more services in a sector.

4."**Special Economic Zone in a port or airport**" means a Special Economic Zone in an existing port or airport.

# SEZs are controlled by a three tier Organizational Set-up described as under:

•Supreme controlling body in the Department is known as The Board of Approval

•At district level, The Unit Approval Committee tackles with SEZs development and other associated issues

•Every district is led by a Development Commissioner, who also controls the Unit Approval Committee.

- ✤ Advantages:
- 15 year corporate tax holiday on export profit
- Allowed to carry forward losses
- No license required for import made under SEZ units.
- Duty free import of goods for setting up of the SEZ units,
- Exemption from payment of Service Tax.
- Setting up Off-shore Banking Units (OBU) allowed in SEZs.
- External Commercial Borrowings up to \$500 million a year allowed without any maturity restrictions 11 SEZ

#### ✤ Disadvantages:

- Revenue losses because of the various tax exemptions and incentives.
- Acquire land at cheap rates and create a land bank.
- May not match up to expectations
- Absence of world-class infrastructure

#### 4.8.2. Special Economic Zones in India

Special Economic Zones in India were established in an attempt to accelerate foreign investment and endorse exports from India and recognizing the need of a global platform to expose the domestic firms and producers to the competitive world market.

The announcement of formulating a Special Economic Zones policy in India was made by the government in April 2000 and was anticipated to be an overseas province for trade purposes, commercial operations, duties and taxes.

SEZs when equipped are **anticipated** to provide premiere infrastructure services and sustenance services, besides permitting for the tariff free import of merchandize and raw materials. Furthermore, attractive financial subsidiaries and trouble-free custom tariffs, banking and other methods are provided in such business zones. Establishing SEZs is also recognized as communications development methods.

## Salient features of Indian Special Economic Zones

Some of the salient features of Indian Special Economic Zones are as follows:

•Indian SEZs are **developed** by government, private and joint sector, unlike its international counterparts where zones are chiefly maintained by their respective governments. This provides equal prospects to both Indian and global players.

•Government has allocated a least favourable area of 1,000 hectares for greenfield SEZs. Although, there are no limitation in context of favourable area in constructing sector specific SEZs.

•100% of **Foreign Direct Investment** is allowed for all endowments in Special Economic Zones, apart from activities catalogued under the unconstructive record.

•SEZ divisions are obligatory to be encouraging net foreign exchange yielders and are not entitle to any least amount of value addition guidelines or export responsibilities.

•Commodity surge from Domestic Tariff Area (DTA) into a SEZ is recognized as exports and commodity surge into DTA from SEZ are recognized as imports.

#### Benefits of SEZs

Besides offering high end infrastructure and availability to a large skilled workforce, SEZ also offers attractive incentives and advantages to firms and developers.

# Some of the benefits of Indian Special Economic Zones are as follows:

- Full Income tax exemption for a period of 5 years and an extra 50% tax relief for additional two years.
- Manufacturing industry is allowed an FDI influx of 100% via automatic channels excluding few industries.
- Services to establish off-shore banking divisions in SEZs
- Service Tax and Central Sales Tax exemption
- External commercial lending of up to US\$500 million is allowed for SEZ divisions in a year sans any maturity limitations via certified banking networks.
- No import authorization obligations.
- Services to sustain foreign exchange proof of payments of up to 100% in Exchange Earners' Foreign Currency Account.
- SEZ franchisees are allowed100% FDI in offering customary telephone facilities in the areas.
- No limitation of foreign endowments for small scale industry reticent products.
- Tax relief from sect oral authorization obligations for goods reticent for SSI industry
- Tax relief from custom tariff on import of merchandize, raw products, spare parts etc
- Tax relief from Central Excise tariff on acquirement of merchandize, raw products, spare parts etc from the local market
- No regular assessments by Customs for export and import freight.
- Capacity to comprehend and repatriate export advances within a year.
- Revenues permitted to be repatriated sans any dividend assessment needs
- Authorization for Employment prospects on behalf of local exporters for direct export.

- Authorization for off-shoring of local and global players. This service is accessible to jewellery sector also.
- State-wise distribution of approved SEZs (As on 21st January, 2015)

Here is the state wise distribution of SEZs.

# 4.9. NEED IMPORTANCE AND DEVELOPMENTS OF TRANSPORTATION

A reliable and efficient transportation system plays a pivotal role in a region's economic growth. A well developed transportation system connects the distant part of the country, provides adequate access to the region which in turn is a necessary condition for the efficient operation of manufacturing, retail, labour and housing markets.

There is the need therefore to maintain and improve the existing transportation and build new infrastructures for a national wealth. The national wealth is the growth domestic products (GDP) which is an indicator or measures of the rate of economic growth. An international study found every 10 percent increase in travel speed; labour market expands 15 percent and productivity by 3 percent (Barrister and Berechinan. 2000).

• Therefore, transport, forms a key input for production processes and adequate provision of transport infrastructure and services helps in increasing productivity and lowering production costs.

4.9.1 The commercial developments of transport are as follows:

# a. <u>Makes available raw materials to manufacturers or</u> producers:

Transport makes it possible to carry raw materials from places where they are available, to places where they can be processed and assembled into finished goods.

#### b. Makes available goods to customers:

Transport makes possible movement of goods from one place to another with great ease and speed. Thus, consumers spread in different parts of the country have the benefit of consuming goods produced at distant places.

#### c. Enhances standard of living:

Easy means of transport facilitates large-scale production at low costs. It gives consumers the choice to make use of different quantities of goods at different prices. So it raises the standard of living of the people.

#### d. Helps during emergencies and natural calamities:

In times of national crisis, due to war or internal disturbance, transport helps in quick movement of troops and the supplies needed in the operation. For example in times of natural calamities, like floods, famines, earthquakes, cyclones etc. and national emergencies like wars transport plays a critical role

#### e. Helps in creation of employment:

Transport provides employment opportunity to individuals as drivers, conductors, pilots, cabin crew, captain of the ship, etc. who are directly engaged in transport business. It also provides employment to people indirectly in the industries producing various means of transport and other transport equipments.

#### f. Helps in labour mobility:

Transport helps a lot in providing mobility to workers. You may be aware that people from our country go to foreign countries to work in different industries and factories. Foreigners also come to India to work. In India, people also move from one part to another in search of work. Similarly, it is not always possible to have workers near the factory. Most industries have their own transport system to bring the workers from where they reside to the place of work.

#### g. Helps in bringing nations together:

Transport facilitates movement of people from one country to another. It helps in exchange of cultures, views and practices between the people of different countries. This brings about greater understanding among people and awareness about different countries. Thus, it helps to promote a feeling of international brotherhood.

It is also necessary for connecting villages with towns, market centres and in bringing together remote and developing regions closer to one another.

#### 4.9.2. Modes of Transport

According to the following features various means of transport are used in different parts of the world:

- topography,
- geographical environment,
- geographical location,
- economic development and
- technological level.

#### Various means of transport are as follows:

- I. In extremely <u>remote areas</u> animals like mules, goats, yaks, including man serve as means of transport
- II. In <u>backward rural areas</u> bullock carts horse carts camel carts serve as means of transport
- III. <u>Motor buses, trucks, tractors, cars</u> popularly used as <u>short</u> <u>distance</u> means of transport.
- IV. <u>Railways</u> carry passengers and goods to <u>distant places</u>. These are particularly useful for transportation over long distances.
- V. <u>Ropeways</u> are used in <u>difficult hilly terrains</u>, nowadays.
- VI. <u>Pipelines</u> carry oil gas and the liquid for distribution in distant places.
- VII. <u>Inland waterways</u> (canals, rivers and lakes) are still widely used as they are the <u>cheapest means</u> of transport.
- VIII. <u>Oceans</u> are by far the greatest carriers of commerce and trade in the modern age as they <u>handle nearly90% of the total cargo of the world.</u>
  - IX. <u>Aeroplanes</u> are the <u>fastest means of transport</u>. In fact the number of quantity of air traffic is an indicator of economic development of a country.

From the above discussion we have learnt that basically <u>transport is possible</u> through <u>land</u>, air or water, which are called the different modes of transport in which several means play a distinct role, each having a definite utility. On land we use <u>trucks</u>, <u>tractors</u>, <u>etc.</u>, to carry goods; train, bus, cars etc. to carry passengers. In air, we find aeroplanes, helicopters to carry passengers as well as goods. Similarly in water we find <u>ships</u>, <u>steamers</u>, etc., to carry goods and passengers. All these are known as various means of transport.

# 4.9.3 The modes of transport can be broadly divided into three categories:

- I. Land transport
- II. Water transport
- III. Air transport.

#### (I.) Land Transport:

Land transport means physical movement of goods and passengers on land. This movement takes place on road, rail, rope or pipe. So land transport may further be divided into

- 1. Road transport,
- 2. Rail transport,
- 3. Ropeway transport,
- 4. Pipeline transport.

**1.** <u>**Road Transport**</u> has been the principle form of competition for the railway. Its main features are as follows:

• It offers <u>flexibility</u>, choice of routes and delivery at the door.

• Roads are the means that connect one place to another on the surface of the land. We have seen roads in our village, in towns and cities. Not all of them look alike. Some of them are made of sand and some may be of chips and cement or coal tar. We find different vehicles plying on roads like bullock carts, cycles, motorcycles, cars, truck, buses, etc. All of these constitute different means of road transport.

## The means of road transport may be divided into three types: -

## i. Man driven :

We have seen individuals carrying goods on their head or back, in bicycles or on *thelas*, move from one place to other. People also ride a bicycle or use rickshaw to travel short distances.

## ii. Animal driven :

We also find animal driven vehicles like carts (drawn by bullocks, camels, horses, donkeys, etc.) used in rural areas to carry crops, straw, fodder and sometimes even In areas, which are normally covered with snow throughout the year, we find sledges pulled by dogs used to carry both passengers and goods.

## iii. Motor driven:

Compared with man driven and animal-driven means of road transport, motor driven means of transport have become more important over the years. This is due to their speedy movement and larger carrying capacity. Extension of roads to every corner of the country has also enhanced the use of motor driven transport. The types of motor vehicles used to carry goods and passengers include auto-rickshaws, scooters, vans, buses, tempos and trucks, etc. In Kolkata, tramway also forms part of road transport for carrying passengers.

## \* Advantages of Road transport

#### Road transport has the following advantages.

- It is a relatively cheaper mode of transport as compared to other modes.
- Perishable goods can be transported at a faster speed by road carriers over a short distance.
- It is a flexible mode of transport as loading and unloading is possible at any destination. It provides door-to-door service.
- It helps people to travel and carry goods from one place to another, in places which are not connected by other means of transport like hilly areas.

## Limitations of Road transport

### Road transport has the following limitations:

- Due to limited carrying capacity road transport is <u>not economical</u> for long distance transportation of goods.
- Transportation of heavy goods or goods in bulk by road <u>involves</u> <u>high cost.</u>
- It is <u>affected by adverse weather</u> conditions. Floods, rain, landslide, etc., sometimes create obstructions to road transport.

## 2. Rail transport

Transportation of goods and passengers on rail lines through trains is called rail transport. It occupies an important place in land transport system of our country.

## Characteristics of Rail transport:

- It is the <u>most dependable</u> mode of transport to carry goods and passengers over a long distance.
- Besides long distance, local transport of passengers is also provided by <u>local trains</u> or <u>metro-rail</u> in some metropolitan cities.
- Rail transport is <u>available</u> throughout the country except some hilly or mountainous regions.
- In India two types of trains are found.

(i.) One is passenger train and other is (ii). goods train. While passenger trains carry both human beings and a limited quantity of goods, the goods trains are exclusively used for carrying goods from one place to another. These trains are driven by rail engines and they use steam, diesel or electric power to move.

Let us now discuss the advantages and limitations of rail transport.

# ✤ Advantages of Rail transport:

### Rail transport has the following advantages

- It is a convenient mode of transport for travelling long distances.
- It is relatively faster than road transport.
- It is suitable for carrying heavy goods in large quantities over long distances.
- Its operation is less affected by adverse weathers conditions like rain, floods, fog, etc.

## Limitations of Railway transport:

## Railway transport has the following limitations:

- It is relatively expensive for carrying goods and passengers over short distances.
- It is not available in remote parts of the country.
- It provides service according to fixed time schedule and is not flexible for loading or unloading of goods at any place.
- It involves heavy losses of life as well as goods in case of accident.

## 3. Pipelines transport

In modern times, pipelines are used for various purposes. Water supply to residential and commercial areas is carried on with the help of pipeline. Petroleum and natural gas are also transported from one place to another through pipelines. This is the most convenient as well as economical mode of transport for petroleum as well as natural gas in comparison to road and rail transport, provided the volume to be transported is large. But the cost of installation and maintenance requires large capital investment.

### 4. Ropeway transport

<u>Ropeway</u> refers to a mode of transport, which connects two places on the hills, or across a valley or river. In the hilly areas, trolleys move on wheels connected to a rope and are used for carrying passengers or goods, especially building materials, food, etc. The famous "*Uran Khatola Jagdamba*" in Gujarat that carries pilgrims to the temple is an example of ropeway transport, which carries more than 100 passengers at a time.

### (II) Water transport

Water transport refers to movement of goods and passengers on waterways by using various means like <u>boats</u>, <u>steamers</u>, <u>launches</u>, <u>ships</u>, etc. With the help of these means goods and passengers are carried to different places, both within as well as outside the country. Within the country, rivers and canals facilitate the movement of boats, launches, etc. Since the goods and passengers move inside the country, this type of transport is called <u>inland water transport</u>. When the different means of transport are used to carry goods and passengers on the sea route it is termed as <u>ocean transport</u>. Let us know further about these two types of water transport.

## Different Means Water Transport:

- i. Inland transport
- ii. Ocean transport

#### i. Inland water transport

- Inland water transport use boats, launches, barges, streamers, etc., to carry goods and passengers on river and canal routes. These routes are called inland waterways.
- These are used in domestic or home trade to carry bulky goods.
- Passenger transports through waterways are not so popular in our country.
- Inland water transport system exists only in a few states like. West Bengal, Andhra Pradesh, Assam, Tamil Nadu, Kerala etc.

## ii. Ocean transport

- Ocean transport refers to movement of goods and passengers with the help of ships through sea or ocean waterways.
- It plays an important role in the development of international trade.

#### 200

- It is also used for transporting goods and passengers in the coastal areas.
- Ocean transport has its fixed route, which links almost all the countries of the world.

Ocean transport may be of the following two types:

- Coastal Shipping -
- i. In this transport, ships ply between the main ports of a country.
- ii. This helps in home trade, and also in carrying passengers within the country.
- Overseas shipping -
- i. In this transport, ships ply between different countries separated by sea or ocean.
- ii. It is mainly used for promotion and development of <u>Internationaltrade</u>.
- iii. It is an economical means of transport to carry heavy machines and goods in bulk.

### Importance of Overseas transport:

• Overseas transport is carried out on fixed routes, which connect almost all the countries.

## Ships used in Overseas transport are as follows:

In ocean transport, different types of ships are used to carry passengers and goods.

These may be classified as under.

a) <u>Liners</u> - A liner is a passenger or cargo vessel, which belongs to a regular shipping company. These ships ply over a fixed route according to a prescribed schedule or timetable.

b) <u>Tramps</u> - A tramp is a cargo ship, which does not make regular trips but plies whenever cargo is offered to it. It does not follow a fixed route or a prescribed timetable like that of liners.

## ✤ Advantages of water transport

Water Transport has the following advantages:

- a) It is a relatively economical mode of transport for bulky and heavy goods.
- b) It is a safe mode of transport with respect to occurrence of accidents.

- c) The cost of maintaining and constructing routes is very low as most of them are naturally made.
- d) It promotes international trade.

#### Limitations of water transport

Water transport has the following limitations.

- a) The depth and navigability of rivers and canals vary and thus, affect operations of different transport vessels.
- b) It is a slow moving mode of transport and therefore not suitable for transport of perishable goods.
- c) It is adversely affected by weather conditions.
- d) Sea transport requires large investment on ships and their maintenance.

#### (III) Air transport

This is the fastest mode of transport.

#### Importance of Air Transport:

- It carries goods and passengers through airways by using different aircrafts like passenger aircraft, cargo aircraft, helicopters, etc.
- Besides passengers it generally carries goods that are less bulky or of high value.
- In hilly and mountainous areas where other mode of transport is not accessible, air transport is an important as well as convenient mode.
- It is mostly used for transporting goods and passengers during natural calamities like earthquake and floods, etc. During war, air transport plays an important role in carrying soldiers as well as supplies to the required areas.

#### \* Air transport may be classified as

- domestic and
- international air transport.
- ✤ Use of Air Transport:
- Domestic air transport mainly used for movement within the country,

- International air transport is used for carrying goods and passengers between different countries.
- Air transport is carried out in fixed air routes, which connect almost all the countries.

## \* Advantages of Air transport

#### It has the following advantages:

- It is the fastest mode of transport.
- It is very useful in transporting goods and passengers to the area, which are not accessible by any other means.
- It is the most convenient mode of transport during natural calamities.
- It provides vital support to the national security and defence.

## • <u>Limitations of air transport</u>

### It has the following limitations:

- It is relatively more expensive mode of transport.
- It is not suitable for transporting heavy and bulky goods.
- It is affected by adverse weather conditions.
- It is not suitable for short distance travel.
- In case of accidents, it results in heavy losses of goods, property and life.

## Different Means Air Transport:

Domestic and International air transport means:

- Aeroplanes
- Helicopters

## 4.9.4. Cost of transportation

The expenses involved in moving products or assets to a different place, which are often passed on to consumers is known as Cost of transportation

# 4.10. COMMUNICATION

Communication system contributes to the development of the economy, social relationships and also helps in promoting cultural unity. Internationally, diverse people of the world are brought closer to one another by communication. In the event of any impending calamity, accident or emergency instant means of communication flash the news across the globe so that relief can be rushed to the spot immediately.

# **Solution** Different means of Communication are as follows:

## 1. Postal Services

It is the most commonly used mode of communication in India. The postal services play a vital role in the rural areas of the country. About 99% of the villages enjoys postal services. At present about 1.55 lakh post offices are providing postal services covering every part of the country. To keep compatibility with the rest of the world the Indian postal services are also being modernised.

## Various postal services are stated under:

- I. **Postal Index Number** or PIN has facilitated the prompt delivery of mail
- II. **Speed post** service has been introduced for fast and quick delivery of post.
- III. Quick Mail Service (QMS) is another step in this direction.
- IV. Satellite money order scheme was introduced in 1994 as a pilot project for providing services to hilly, backward and remote areas from six principal cities.
- V. **International mail services** carried by air and sea is an important step in linking the foreign countries with India.

# 2. Telecommunication

It is the modern device for the communication at individual and mass level.

**Telegraph, Telephone; Talex and Fax** are the main means of tele communication.

- I. **Telegraph:** is comparatively an old mean for providing quick communication in event of any emergency. At present about forty thousand telegraph offices have been working in the country.
- II. **Telephone:** There has been a very fast progress in telephone facilities. As on 31 March 2006, the network comprises of 142.09 million telephone connections and over 2.34 (February,

2006) million Public Call Office (PCOs). There are over 62.90 million cellular subscribers in the country and the cellular customer base is growing at the rate of over two million per month. Telephone services have been expanding very rapidly in the country. STD (Subscriber Trunk Dialling) facilities are available to all the big and small towns of the country. Fully automatic International Subscriber Dialling (ISD) service is available to almost all the countries.

III. **Telex:** Telex services make possible to send information in printed form. More than 200 cities of India enjoy the service. Use of satellite has revolutionized the Tele communication system today.

## 3. Mass - Communication

Radio and television are the electronic media of mass communication. They play an important role in individual and social life.

- I. **Radio** is a powerful medium which provide all sorts of useful information, news and variety of entertainment. There are about 223 radio broad casting stations in the country and provide services to 91.42% of the area and 99.13% of the total population. Now, FM Radio services have given a new face to radio transmission.
- II. Television service was started in 1959 in India. However, the real expansion of T.V. Service began after 1980. Only recently several channels on television have been made available to private parties. This has promoted keen competition to improve the quality of programme even of Doordarshan. Doordarshans network consist of (i) 64 Doordarshan Kendra (studio centres); 1400 transmitters (1134 transmitters for DD1, 153 transmitters for DD News, 109 transmitters for regional services and 1 digital transmitters each at Delhi, Chennai, Kolkata, and Mumbai). DD1 provide services 79% of area and about 91% of the total population.
- **III. Cinema** is yet another mean of mass communication. It entertains millions of people every day.

## IV. Print media

Newspapers, periodicals and journals fall in the category of print media. Print media expanded very rapidly after independence.

There were 62,550 daily newspapers, periodicals and different journals in Indian languages on 31st March, 2006. These were 6,800 dailies, 369 tri/bi-weeklies, 21,453 weeklies, 8,227 fortnightlies, 18,545 monthlies, 4,340 quarterlies, 584 annuals, and 2,232 of the other periodicity. The largest number of newspapers and periodicals registered in any Indian language is in Hindi (24,017), second is English (8,768).

# 4.11. PROBLEMS OF TRANSPORT

## 2. Faulty Planning of Transport system:

The heavy pressure on rail and road transport in certain cities and regions has lead to the development of transport system unbalanced. For balanced development alternative routes should be developed as it is seen that he Delhi metro has decreased the pressure on road transport. Moreover, lack of fast and adequate public transport system in the metropolitans has encouraged the explosion of personal transport which again put extra pressure on the roads. It is also observed that hilly and remote areas lack all weather transport facilities.

## 3. Lack of rail-road co-ordination:

The main two means of transportation of India, Rail and Road transport, should work in co-ordination. The present share of road transport in freight and passenger traffic is 60% and 80% respectively whereas the same share in 1951 was 11% and 26% respectively. This growth is not desirable from the economic and environmental point of view. The railways must be engaged in a planned way for bulky goods and long distances while road transport should be engaged for small goods and short distances.

# 4. Lack of Improved Technology:

We are using age old technology in our road and railway transport system, like our engine design, signalling system, multiaxle vehicles, and worn out tracks are the main problems in railway system in India.

## 5. Worn-out and obsolete assets:

There is old and obsolete infrastructure in all modes of transport in India.

✤ Road transport of the country is facing a number of problems. Some of these problems are discussed below:

## 1. Bad Roads:

The roads in India are not properly metalled(42.65%) and many are even Kucha Roads. They are not suitable for use of vehicular traffic. The vehicles have to bear more wear and tear and the cost of operating them is unreasonably high. The poor maintenance of the roads aggravates the problem especially in the rainy season.

## 2. Mixing of traffic:

One major problem on the Indian roads is the mixing of traffic. Same road is used by high speed cars, trucks, two wheelers, tractors, animal driven carts, cyclists and even by animals. Even highways are not free from this malady. This increases traffic time, congestion and pollution and road accidents.

## 3. Slow Growth of Vehicles:

There is slow growth of commercial vehicles because of higher operation costs. The increase in rates of fuel and the high prices of vehicles due to heavy excise duties are the factors responsible for the slow growth of commercial vehicles. To these the exorbitant taxes on commercial vehicles may also be added.

## 4. Role of private sector

There is very little participation of private sector in road development in India because of long gestation period and low-returns.

# 5. Lacking stability in policy

There has been no stability in policy relating to highway development in the country. It has changed with the change of government. There are a number of agencies which look after the construction and maintenance of different types of roads. Since there is no co-ordination between these agencies their decisions are often conflicting and contradictory.

## 6. Lack of Co-ordination:

Lack of co-ordination between the centre and the states in another major problem as the states and the centre try to shift the burden on each other regarding the construction and maintenance of main highways. It has resulted in the blocking of rapid development of roads in India.

## 7. Shortage of Funds:

There is shortage of funds for the construction and maintenance of roads.

#### 8. Competition among Different Modes:

There is a competition among different modes of transport. The transport policies of different states are different. Some highways have more traffic while on others there are not sufficient transport services.

# 4.12. INTERNAL TRADE

Buying and selling of goods and services within the geographical boundaries of a country is known as internal trade, domestic trade or home trade. This may take place among buyers and sellers belonging to the same locality, village, town or city or may be in different states. But the trade must be within the same country. **Features of Internal Trade**:

(a) The buying and selling of goods takes place within the boundaries of the same country.

(b) Payment for goods and services is made in the currency of the home country.

(c) It involves transactions between the producers, consumers and the middlemen.

(d) It consists of a distribution network of middlemen and agencies engaged in exchange of goods and services.

- This may be sub-divided into two categories
- a. wholesale and
- b. retail
- a. <u>Wholesale trade</u>
- It is concerned with buying goods from manufacturers or dealers or producers in large quantities and selling them in smaller quantities to others who may be retailers or even consumers.
- The wholesaler generally deals in one or few variety of items such as machinery, textiles, medicines etc
- Wholesale trade requires a large amount of capital to be invested

- It also requires large storage space
- Wholesale traders are also involved in activities like packaging, grading, advertising, market research, etc.

## b. <u>Retail trade</u>

- It refers to buying goods from the manufacturers or wholesalers and selling the same to the ultimate consumers. Those who are engaged in retail trade are called retailers.
- The retail trader generally deals in a variety of goods.
- A retailer makes purchases from producers or wholesalers in bulk for sale to the consumers in small quantities according to their requirements.
- Retail trade is normally carried on in or near the main market area.
- Generally retail trade involves buying on credit from wholesalers and selling for cash to consumers.
- A retailer has indirect relation with the manufacturer (through wholesalers) but a direct link with the consumers.

# 4.13. GEOGRAPHICAL FACTORS AFFECTING INTERNATIONAL TRADE

The physical and biological factors that are tied to geographic location, including climate, the distribution of wild plant and animal species, soil and topography are called Geographical factors.

## 4.13.1. International Trade

## Definition

International trade is the exchange of commodities, products, services, capital between people and companies in different countries. This type of trade gives rise to a world economy, in which prices, or supply and demand, affect and are affected by global events. It form a significant part of many countries "GDP". International trade has existed for long. But trade has increased hugely in the past few hundred years having major impact on international economy. Trading globally gives consumers and countries the opportunity to be exposed to goods and services like food, clothes, spare parts, oil, jewellery, wine, stocks, currencies

and water, not available in their own countries. Services like tourism, banking, consulting and transportation are also traded: A product that is sold to the global market is an export, and a product that is bought from the global market is an import. Imports and exports are accounted for in a country's current account in the balance of payments.

# By the Measurement of Import Trade and Export Trade, the International Trade may be classified as the following Trade Types

**1. Balanced Trade**: When the trade-value of import and export trade of a particular country is equal, it is known as balanced trade.

2. **AdverseBalanced Trade**: When the import trade-value is more than the export trade value, it is known as adverse balanced trade.

3. **Favourable Balanced Trade:** When the import trade-value is less than the export trade value, it is known as favourable balanced trade.

The international trade can be between the two countries (bilateral) or among the countries more than two (multilateral). Similarly, the trade can be visible or invisible in nature. In the visible trade, the commodities are directly sold or consumed, while in the invisible trade, the commodities are directly sold but they can be economically benefited to a country i.e., tourism.

## Importance of International Trade

The importance of international trade can be stated as:

- A commodity can be consumed irrespective of its production in the country.
- The goods are available with the reasonable rates through international trade.
- A specialization in a particular production may be done.
- Different commodities or goods may be chosen as per our liking.
- The calamities can be faced by importing the commodities in such situations, i.e., earthquakes, draughts.
- The ideas, thoughts may be exchanged.
- An opportunity of enjoying the scarce resources may be possible.
- The benefits of division of labour are obtained by all.

## \* Trade Affected due to Geographical Factors

Any country's bilateral or multilateral trade is affected by

- A. geographical position,
- B. natural resources,
- C. economic development level and
- D. political factors.

## The Geographical Factors are as Follows

1. **Climate**: Geographical location is one of the most important factors in trade development. It means the location of a country controls its climate in one hand and trade on the other. The climate on earth is not similar at all locations. The types of crops, animals, vegetation depend on climate. Three climatic zones are found on the earth in general:

- tropical,
- temperate and
- cold

The crops like tea, coffee, rubber, coco, coconut, sugarcane, rice, etc, are grown in tropical zone; while a variety of vegetables, maize, wheat, and different fruits are grown in temperature zone. In cold zone hairy leather is obtained. The trade of such commodities is involved within the regions.

It is observed that the poorest locations are in the tropics, where the climate is hot, the land is less fertile, water is scarcer, and where diseases flourish, hence trade is hindered. Conversely, Europe and North America profit from huge tracts of very fertile land, a temperate climate, and good rainfall. In extremes of climate, either hot or cold, too much energy goes into the simple business of survival for development.

Some countries are just at a natural disadvantage where rain patterns may give a short growing season, while others can get two harvests in one year.

## 2. Relief Conditions:

- Earth's surface is covered by mountains, plateaus and plains. A similar type of relief is not found all over the earth.
- Sometimes agriculture is delimited in mountainous region but the same region may invite ideal locations for tourism, giving

rise to the invisible foreign trade.

- In plateau and plain region, different productions through the occupations like agriculture, animal rearing, mining, transportation and communication, manufacturing may be obtained and the international trade may be increased.
- But if the natural conditions on plateau and plains are unfavourable, the scope for producing commodities becomes limited. i.e. regions with snow cover, desert region. Similarly, the uneven distributions of natural resources like water, soils, vegetation and animal, affects the international trade.
- In mid-latitude moderate climate, coastal areas, the transportation is convenient, good for development of international trade.
- High-latitude climate, cold, inland mountainous area cause traffic block, which is adverse to the development of international trade. Japan, with its island position has the advantages to the development of bilateral trade between neighbouring countries.

#### 3. Location:

- Geographical location plays a pivotal role in access to markets.
- Since time immemorial, all the great empires have been based around trade routes, and in most cases, almost always maritime.
- Trade suffered in many of the world's poorest countries because they are landlocked or situated in high mountains.
- On the contrary, countries having long coastlines or good natural harbours haveourable conditions for the development of trade.
- From the ports moey can be raised through tolls and shipping services. China haseld's busiest ports, and so does the US.
- Access to the coasts favours transportation and trade as transportation by land, is expensive. Russia being ice-bound on its northern coastlines, has squabbled for centuries over the access to a warm water port and hence, the Crimean war.

- Countries like Afghanistan, Rwanda, Malawi, or Bolivia are all hindered by no access to ports.
- Other countries like Ethiopia or Lesotho are not only landlocked, but also mountainous, making trade even more expensive.

#### 4. Resources:

- Resources form the backbone of the economy of a nation.
- Without land, water, forest, air, mineral one cannot develop agriculture or industry.
- Uneven distribution of national resources like land, climate, water, minerals, vegetation and animal life controls international trade.
- The earth is a store-house of various minerals, but their distribution over the earth is very uneven.
- The countries, having rich deposits of minerals, develop mining and export the minerals and the products produced out of minerals i.e. the export of mineral oil from Middle-East countries.
- The minerals got greater importance after the industrial revolution.
- The industrial development was achieved due to the minerals, which encouraged the international trade.
- There must be proper infrastructure to capitalize on these.
- But some places have a distinct advantage over the other regarding resource and its utilisation. In this case Mineral Oil is the most obvious.
- There is no doubt about how Saudi Arabia or UAE have made money by trading oil. South Africa has the advantage of resources like gold and diamonds which have helped her build the most successful economy on the continent.
- Although these are all non-renewable resources, trading may be continued till they last.
- On the other hand the renewable resources, forests, fish, etc. if correctly managed, will replenish them, and trade based on

- Moreover, wind, tide and solar energy, known as "flow resources', are renewable and need no management. The Earth Policy Institute describes the American Great Plains as 'the Saudi Arabia of wind Energy', while sunshine-rich places like California, Sicily and Portugal are able to invest in solar power. No natural resource is a license to print money, and there are plenty of poor countries who are rich in resources, but it is a factor.
- The type and degree of a country's natural resource directly affect the country's International Trade in primary products. Such as Zaire is said the "Mid-Africa gem", in the national export commodities, Minerals (70%-80%).

# 5. Stability:

- Mohammad Yunus in his book Banker to the Poor states that environmental stability can be a factor in the development of trade.
- Some countries are more stable than others. Bangladesh, a land of natural disasters, is unstable in this respect. So this factor becomes important regarding development of trade in this area.
- Also regular beset of monsoons, floods and landslides, as it happens in countries like Bangladesh or in Philippines, things become harder.
- Even an earthquake zone, hinders trade. And we've all seen what a tsunami can do.

# 6. The Level of Economic Development:

- Economic Development level of a country can directly affect the foreign trade, commodity structure and the position of her in international trade.
- The United States, Japan and the European Union's national economic development level is high, the imports and exports accounted for half of the world and the population of the country accounts for only about 1/7 of the world.

• Developing countries have a relatively backward economy; as a result, foreign trade is relatively less.

## 7. Political Factors:

• The world's political relations and the policy of a country also have big impact on international trade. The gulf war occurred because Iraq's oil exports plummeted due to political reasons. Since the late 1970s, China adopted a policy of opening up its economy to the outside world, hence foreign trade developed quickly.

8. Other factors that affect trade are currency, technology, labour, transportand communication.

# 4.13. 2. India's Foreign Trade

## History of Indian Trade

Trade means exchange of goods. Since time immemorial India possesses arich and a long history of trade. From ancient times till the establishment of theBritish Empire, India was famed for enormous wealth. Even during the medievalperiod, the country did not lose its prosperity despite facing frequent political disturbances. The trade in different phases of the Indian history has been discussed below.

## • Trade during the Sultanate Period

During the sultanate period, from the early 13th to the 16th century, the economies of the towns flourished because of Indian trade. This was due to the establishment of sound currency system based on silver "tanka" and copper "dirham". During this period important caters of Indian trade and industry were Delhi, Lahore, Bombay, Ahmedabad and Jaipur.

# • Trade During the Mughal Period

During the two hundred years of the Mughal era, from the 16th to 18<sup>th</sup> century, the Indian trade received a further growth. The Mughal era witnessed the establishment of a stable centre and uniform provincial government. During this age of relatively peace and security trade and commerce flourished.

The prime urban centres of Indian trade during the Mughal era were Agra, Delhi, Multan, Lahore and Srinagar in the north, and Ahmedabad, Bombay, Surat, and Ujjain in the west. The trade centres in the eastern part of the country were Dhaka, Patna, Hooghly, Chittagong and Murshidabad. India was known widely for is textiles, which was one of the chief items of the export. The Indian handicrafts were the most eye catching features in the trade.

## • Trade During the Medieval Period

Medieval India witnessed trade at domestic level. The most superior quality of rice and sugar from Kannauj, wheat from Punjab, betel leaves from Dharr in Madhya Pradesh found their way to the markets of Delhi. Well-maintained roads connecting various parts the country facilitated domestic trade.

## • Trade During the Present Period

Indian trade has not only reached its peak with almost all countries of the world in the present century but also flourished in the domestic trade as well. Now India exports both capital goods, foreign trade goods.

# 4.13.3. Economic Liberalisation Heralded Indian Foreign Trade1991 Economic Reform

Since the 1991 economic liberalisation, with the increase in foreign trade, India's economy has improved noticeably. Prior to that, India was a closed economy and trade did not flourish extensively due to the average tariffs exceeding 200 percent and the extensive quantitive restrictions on the imports. Foreign investment was strictly restricted, only to allow Indian ownership in the businesses.

## Exports and Imports

- India exports approximately 7500 commodities to about 190 countries and imports around 6000 commodities from 140 countries.
- India exported US\$318.2 billion and imported \$462.9 billion worth of commodities in 2014.
- According to the ministry of commerce the 15 largest trading partners represent 60% of the total trade by India and 80% of its trade deficit in the financial year 2012-13. In the year 2013-14, mineral fuels are the largest traded item with 58.465 billion US\$ Worth.

 Gold and its finished items are the second largest item traded item with 58.465 billion US worth imports. These two commodities constitute 53% total imports, 34%total exports and nearly 100% of total defect.

# 4.13.4. Foreign Trade Policy 2009-2014

The Government of India announced Its Foreign Trade Policy in the Year 2009 when the world was facing recession. This affected export of many countries. India's trade also suffered. Announcing a foreign trade policy by the government in this economic situation was a very difficult task. Before defining the objective of the new policy it would be useful to take stock of our achievement in the foreign trade over the five years. The foreign trade policy announced by the government in 2004 had set two objectives namely,

1. To double our percentage share to global merchandise trade within 5 years and

2. Use trade expansion as an effective instrument of economy's growth and employment generation. Looking back, we can say with satisfaction that the government has delivered on its promise.

## Short Terms Objectives

The short term objective of our trade policy is to increase the exports and to provide additional support especially to those sectors which have been hit badly by recession in the developed world. We would like to set a policy objective of achieving an annual export growth of 15 percent.

## Long Term Objectives

The government should follow a mix policy measure to provide adequate confidence to our exporters to support employment. The government wants to provide a stable policy environment conductive for foreign trade. The government also wants to enhance insurance coverage under foreign trade policy. It was decided to take initiative to diversify the exports markets. We have signed a comprehensive economic partnership agreement with South Korea which will give enhanced market to Indian exports We have also signed a trade in goods agreement with a season which came in force from 1st January 2010. The government wants to provide brand India through six or more "made in India" shows to be recognized across the world every year. In the era of global
competitiveness, there is an urgent need for Indian exports to upgrade their technology and reduce their costs. For up gradation of export sector, infrastructure, "town of export excellence" and the units located there in would be granted additional focused support and incentives exam bank will provide more finance to the exporters in order to reduce the transaction costs and institutional bottlenecks, the e-trade projects would be implemented.

# 4.14. BALANCE OF TRADE

**Balance of trade**, the difference in value over a period of time between a country's imports and exports of goods and services, usually expressed in the unit of currency of a particular country or economic union (e.g., dollars for the United States, pounds sterling for the United Kingdom, or Euros for the European Union). The balance of trade is part of a larger economic unit, the balance of payments (the sum total of all economic transactions between one country and its trading partners around the world), which includes capital movements (money flowing to a country paying high interest rates of return), loan repayment, expenditures by tourists, freight and insurance charges, and other payments.

If the exports of a country exceed its imports, the country is said to have a favourable balance of trade, or a trade surplus. Conversely, if the imports exceed exports, an unfavourable balance of trade, or a trade deficit, exists. According to the economic theory of mercantilism, which prevailed in Europe from the 16th to the 18th century, a favourable balance of trade was a necessary means of financing a country's purchase of foreign goods and maintaining its export trade. This was to be achieved by establishing colonies that would buy the products of the mother country and would export raw materials (particularly precious metals), which were considered an indispensable source of a country's wealth and power.

The assumptions of mercantilism were challenged by the classical economic theory of the late 18th century, when philosophers and economists such as Adam Smith argued that free trade is more beneficial than the protectionist tendencies of mercantilism and that a country need not maintain an even

exchange or, for that matter, build a surplus in its balance of trade (or in its balance of payments).

A continuing surplus may, in fact, represent underutilized resources that could otherwise be contributing toward a country's wealth, were they to be directed toward the purchase or production of goods or services. Furthermore, a surplus accumulated by a country (or group of countries) may have the potential of producing sudden and uneven changes in the economies of those countries in which the surplus is eventually spent.

Generally, the developing countries (unless they have a monopoly on a vital commodity) have particular difficulty maintaining surpluses since the terms of trade during periods of recession work against them; that is, they have to pay relatively higher prices for the finished goods they import but receive relatively lower prices for their exports of raw materials or unfinished goods.

#### 4.14.1 India Balance of Trade

India recorded a USD 6542 million trade deficit in February of 2016, lower than a USD 6742 million gap a year earlier and below market expectations of a USD 6750 million shortfall. It is the lowest deficit since September of 2013. Exports fell 5.66 percent year-on-year to USD 20738 million, the 15th straight month of decline as non-petroleum exports decreased 2.69 percent. Imports dropped 5 percent year-on-year to USD 27280 million, the lowest since August of 2010. Oil purchases slumped 21.92 percent and gold purchases shrank 29.49 percent. Balance of Trade in India averaged -2105.38 USD Million from 1957 until 2016, reaching an all time high of 258.90 USD Million in March of 1977 and a record low of -20210.90 USD Million in October of 2012. Balance of Trade in India is reported by the Ministry of Commerce and Industry, India.

# 4.15 SUMMARY OF THE CHAPTER

In this chapter we have learnt about the role of industries in the Indian economy and how Industries have helped in the urbanisation, industrialisation, use of resources, increase in per capita income etc. Major industrial regions along with the minor ones have also been taken into consideration. We have studied three major industries of India i.e. Iron and steel, Cotton Textile, Engineering Industry, reasons behind their growth and development, different centres of production, problems solutions and future prospects.

The meaning and importance of transportation and communication and the India's road and rail, water and air routes have been studied. We have also examined the advantages and disadvantages of types of transportation. Comparison of various modes of transportation, cost of transportation, significance of transportation and its effects on economic developments of a country has also been taken into consideration. The dependence of occupations, like agriculture, industries, trade, and tourism on the transport and communication system are very important and therefore, the transport routesare known as the 'life lines' of human life. Moreover, it is learnt that the information from any corner of the world can be received through communication media which helps in the economic development and globalization. In this lesson, you have learnt the relative importance of transport, communication and trade in India.

# 4.16. GLOSSARY

- Urbanisation is the process of creating towns in country areas
- Trade activity of buying and selling
- Per capita income the total amount of income in a country divided by the number of people in that country
- Management the control and organising of a business
- Import buying products from another country
- Front selling products from another country
- Production manufacturing something in large quantities
- Resources- land, water, air, minerals, animals, vegetation, etc.
- Human resource population: a source of development.
- Transportation Carrying of persons or commodities from one place toanother.
- Inadequate- not sufficient
- Perishable –easily gets rotten
- Topography-terrain

# **4.17 CHECK YOUR PROGRESS**

#### 1. Fill in the blanks

- a. \_\_\_\_\_ has played a pivotal role in the field of science and technology.
- According to Jones and Darkenwald the manufacturer of an industry must have easy access to \_\_\_\_\_, power, labour, capital and markets
- c. The Hugli Industrial Region is located in \_\_\_\_\_, extends as a narrow belt running along the river Hugli.
- d. The engineering industries may classified into two categories Heavy Engineering Industry and \_\_\_\_\_ Engineering Industry
- e. The cotton textile industry in Indian was initiated with the establishment of the first cotton textile factory at \_\_\_\_\_\_ near Kolkata in 1818.
- f. Transportation and is a tertiary activity.
- g. Transport is possible through \_, \_\_\_or water.
- h. It is also necessary for connecting villages with <u>,</u> and market centres.
- i. A liner is a cargo vessel.
- j. Different means water transports are \_\_\_\_\_, ocean transport.

#### 2. True or False

- a. Mumbai gets raw cotton from the neighbouring region of Alluvial soil that produces raw cotton.
- b. Ahmedabad is called the "Manchester of India" because it has similarity with the famous cotton textile centre of Manchester, Great Britain.
- c. Through the process of production analysis, Weber came to know that there were certain costs in the total cost of production which are directly influenced by geographical factors
- d. Since steel is basic to the manufacture of automobiles, this industry prefers its location near iron and steel centres

- e. Assured availability of raw-materials, labour, and power would ensure steady growth of any industry.
- f. Water supply to residential and commercial areas is carried on with the help of pipeline.
- g. For the economic development of a country means of transports are not essential.
- h. Adequate provision of transport infrastructure and services helps in increasing productivity and lowering production costs.
- i. Transportation does not help during emergencies and natural calamities.
- j. Transportation makes available raw materials to manufacturers or producers.

#### 3. Multiple choice questions

1. An industry's production and employment increase rapidly by

i. Applying advanced technology, division of labour and scientific management

- ii. Creating marketing problems
- iii. Creating Labour unrest
- iv. Only abundant supply of raw material

2. Jamshedpur, (TISCO) steel plant is well connected to coal fields of,

- i.Damodar valley in Jharkhand
- li.Raniganj, West Bengal
- lii. Jahria mine
- 3. Ahmedabad cotton Textile region gets cheap hydel power from
- i. D.V.C, West Bengal
- ii. Ukai, Gujarat
- iii.Raniganj, West Bengal
- iv.Bokaro

4. The western cotton Textile region of India enjoys the humid climate as it is adjacent to the.

- i. Bay of Bengal
- ii. River Ganga
- iii. Arabian Sea
- iv.Indian Ocean
- 5. Heavy engineering Industries manufacture
- i. Watch
- ii. Automobiles
- iii. Cotton textile

lv.jewellery

- 6. Transports are essential because
- I. it connect different parts of the country
- II. vast natural resources can be kept in reserve
- III. it is cheap travelling by air
- 7. Inadequate transportation
- I. provides easy transportation of heavy goods
- II. limits nation's ability to utilise natural resources
- III. helps in easy movement in the remote areas
- 8. Ropeway connects
- I. two places on the hills or across the river
- II. two places on the road
- III. nothing
- 9. Railway transportation is relatively expensive for
- I. short distances
- II. long distances
- III. not at all expensive

- 10. Name the trade carried between the countries:
- I. National trade
- II. free trade
- III. international trade
- IV. none of these.
  - 11. Which is the world's longest highway?

I.Moscow-Irkutsk trans Canadian II.New York-San Francisco III.Varanasi-Kanyakumari IV.None of these

12. In which type of transportation 'door to door' service is possible?

i. Road transport ii Rail transport iii Water transport iv. Air transport

# 4.18 CHECK YOUR ANSWER

- 1. a. Industrialisation
- 1. b. raw materials
- 1 .c. West Bengal
- 1.d. Light
- 1 .e. Ghusuri
- 1f. economic
- 1g. land, air
- 1h. towns
- 1i. passenger
- 1j. inland
- 2. a. False, black soil.
- 2. b. True
- 2. c. False, process of cost analysis
- 2. d. True
- 2. e. True
- 2f. true
- 2g .false
- 2h. true

- 2j. True
- 3.1.i
- 3.2.iii
- 3.3.ii
- 3.4.iii
- 3.5.II 3.6. I
- 5.0. I
- 3.7. II 3.8. I
- 3.9.1
- 3.10. lii
- 3.11. I
- 3.12. I

# 4.19. ANSWER THE FOLLOWING QUESTIONS

- 1. What are the factors affecting the location of industries?
- 2. What are the problems of cotton textile industry of India?
- 3. State the reasons for the localisation of Iron Steel Industry in Rourkela.
- 4. State how industrialisation has helped in the economic growth of India.
- 5. Classify Engineering Industry. Describe any two of them.
- 6. What is the importance of transportation?
- 7. What are the various modes of transportation?
- 8. Write short notes on
- a) Land transportation
- b) Inland water transportation
- 9. What are the disadvantages of air transportation?
- 10. What are the advantages of land transportation?
- 11. What are the merits of waterways?
- 12. How are bulky and heavy goods transported?
- 13. Compare the merits of land and air transportation system.
- 14. Analyse the cost of any two types of transportation system.
- 15. How has transportation helped in international trade?

# 4.20. TASK

- 1. In a mp of India point out the location of Iron Steel Plants of India
- 2. In a map of India show the four major cotton textile regions.
- 3. In a map of India show the important rail routes.
- 4. In a map of India show the important rail route for raw material collection for iron steel industry of TELCO.
- 5. Compare the advantages of land transportation against water transportation in tabular form.
- 6. State the different modes of transportation in land, water and air in tabular form.

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# PRACTICALS

# Concept of Statistical diagrams and Maps: Importance of statistical diagrams in Geography

Statistical diagrams are a diagrammatic representation of numerical form of statistical data. Statistical diagrams represent numerical data into a diagrammatic form which is most illustrative. Statistical diagrams are drawn to scale and so are proportional to the quantity represented.

When these statistical diagrams are superimposed on maps it is known located proportional distribution map which reveals spatial dimensions of location and variations of the given phenomena.

A social scientist is required to represent various types of statistical information on a map that helps to represent spatial distribution and concentration of any particular phenomenon under study. For example, spatial distribution of world population. In the contemporary era the field of social science has got specialized t develop into various branches of Geography, History, Economic, Sociology, Psychology, Political Science etc. The representation of the statistical information has therefore occupied more significance. The real distribution of various spatial elements such as temperature, precipitation, atmospheric pressure, production of agricultural produce, mines and minerals; industries and industrial products, concentration and distribution of population, nature of trade and areas connected; traffic flow of mode of transport etc. on map can be shown very effectively with appropriate statistical diagrams given the availability of data/information. Such maps in which a cartographic representation of certain statistical information is made are more illustrative and comprehensive in nature that creates better understanding and are of great socio-economic interest. They are called as 'Thematic maps'. Such maps are extremely useful, particularly from the view point of laymen, since they give a broad overall picture of entire range of data in a highly compressed form that become easy to compare and distinguish with a number of elements represented in the map.

Cartographic representation of statistical information has however, some limitations. Though cartograms are more easily understood and very impressive to the laymen, they are not so very precise as tabulations. When a wide variety of inter-related data are to be represented by diagrams they become very complex and so are difficult to interpret.

#### What is Cartography?

Cartography or mapmaking is the study and practice of making maps. Map making involves the application of both scientific and artistic elements, combining graphic talents and specialized knowledge of compilation and design principles with available techniques for product generation.

Modern Cartography like many other fields of "information technology" has undergone rapid changes in the last decade. Rather than merely drawing maps the cartographic process is concerned with data manipulation, data capture, image processing and visual display. The International Cartographic Association defines cartography as the discipline dealing with the conception, production, dissemination and study of maps. Cartography is also about representation – the map. Cartographic representations may appear in printed form or as dynamic images generated on a computer display screen. Computer assisted mapping systems have added a new and exciting dimension to cartographic techniques and traditional methodologies have to be augmented with new skills. The fundamental nature of cartography has changed with the evolving technologies, providing cartographers with new methods for visualization and communication of spatial information.

While representing various types of data on a map or with the help of some diagrams, certain general rules must be observed. Each map and diagram must be represented with suitable **title** in few words, to give the main idea of the **theme** / topic given in a map or a diagram. Besides other elements of a map or diagram it includes:

- i) **Scale**: it represents the proportions that are quantifiable.
- ii) **Index:** depicting various aspects shown in the map.
- iii) **Clarity and legibility:** precaution is taken to avoid overcrowding of information so that the given distribution of information is clear and legible.

To represent statistical data a very wide range of diagrams are used. Depending upon the range of the given data (that is difference between the lowest and highest figure) different types of graphs/ diagrams are drawn. These are classified as follows:

- i) One dimensional or linear diagrams in which the data to be represented is made proportional to the length of the bar. e.g. Graphs and bars.
- ii) Two dimensional or areal diagrams, such as rectangles, squares and circles. In these diagrams, the area of the rectangle / square or circle is made proportional to the quantity represented. Here square roots are considered while determining the scale.
- iii) Three dimensional or volumetric diagrams, such as cubes and spheres. In such diagrams, the volume of the cube or sphere is made proportional to the quantity represented. Here cube roots are considered while determining the scale.

#### 2. LINEAR DIAGRAMS

**2.1 Simple Line Graph:** Data related to time variable (i.e. Decades, years, months, weeks, days, hours etc.) is normally represented with the help of simple line graph to observe the trend in the growth over a period. For example, the decadal growth of population in Maharashtra from 1961-2011. (Please note one decade = ten years time period).

Formula used is: DGR = (pop.1961 - pop of 1971) \* 100(Pop 1961)

Year	Total Population	Pop. In millions	Decadal Growth rate
1961	39,553,718	39.6	-
1971	50,412,235	50.4	27.5
1981	62,784,171	62.8	24.5
1991	78,937,187	78.9	25.7
2001	96,878,627	96.9	22.7
2011	112,372,972	112.4	16.0

# Table 1.Decadal Growth of Population in Maharashtra (1961 - 2011)

In this data (a) year & (b) population are the two variables. Year (or time) is considered as an **independent variable** and is normally represented along **'X' axis** of the graph. Population is considered as a **dependent variable** (as population is dependent or related to time period /year) which is represented along 'Y' axis on graph. The simple graph (figure 1) represents that the population in Maharashtra is growing over the period from 1961 to 2011. However the decadal growth rate of population is decreasing from 1991 to 2011. This may probably be attributed to the fact of decreasing family size, as also may be migration has slowed down due to socio-economic development in earlier low performing states of the country.



Figure 1

**2.2 Superimposed / Multiple Line Graph:** In this case more than one simple graph are drawn on same axis; hence is called as the superimposed graph. Comparison of two or more graphs is possible in this type of graph.

Table 2.						
Maharashtra:	Rural	– Urban	composition	of	total	population
(1961-2011)			-			

Year	Maharashtra Population 1961-2011 (figures in millions)					
	Rural	Urban	Total			
1961	28.4	11.2	39.6			
1971	34.7	15.7	50.4			
1981	40.8	22.0	62.8			
1991	48.4	30.5	78.9			
2001	55.8	41.1	96.9			
2011	61.6	50.8	112.4			

Sketch pens of different colours can be used to represent lines representing total, rural and urban population on the graph paper.



Figure 2
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Multiple / superimposed line graph depicts the trend (change) in the variables represented. Besides, we can also compare the changes between them. It would thus help in understanding the past and present status and predict the future possible trend under the given conditions. It is important to know the past, present and future for planning policies to meet the development goals in the related sectors. Table 2 depicts the growth and composition of rural and urban population in Maharashtra. It is clear that both rural and urban population is increasing over the period from 1961 to 2011 in Maharashtra. However the rate of growth in urban population is rapid compared to rural population in the state. This proves that Maharashtra state is getting highly urbanized over the period (figure 2).

**2.3 Band Graph:** Comparison of more than two variables as well as total of any aspect (or variable) can be represented in this diagram. For example following data (table 3) explains the concept of band graph:

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10			ν.

#### Production of crops (1961-1991 in '000 tons)

Year	Production (in '000 tons)					
	Rice	Wheat	Jowar			
1961	30	60	10			
1971	50	30	20			
1981	70	50	30			
1991	40	80	40			

Time or independent variable is represented along "X' axis. Dependent variable is represented along \*Y' axis. Graph for the first variable is drawn as simple graph. This graph line of first graph is considered as base line for the second graph of second variable. The graph line of second graph is considered as base line for the third graph of third variable etc.

In this example graph of rice will be drawn first. This graph line is considered as base line for the graph of wheat. To simplify this process the original data is modified as follows:

#### Table 4: Production of crops (1961-1991 in '000 tons)

Year	ar Production (in '000 tons)						
	Rice	Wheat	Rice + Wheat	Jowar	Rice + Wheat + Jowar		
1961	30	60	90	10	100		
1971	50	30	80	20	100		
1981	70	50	120	30	150		
1991	40	80	120	40	160		

The graph lines of this band graph are drawn in the following sequence:

i) Graph for Riceii) Graph for Wheat is Rice + Wheat

iii) Graph for Jowar is Rice + Wheat + Jowar



Figure 3

The advantage/significance of band graph is we can identify the trend of change in individual element/variable represented in the graph at a glance. Secondly, we can identify at a glance the dominant variable in the given distribution. Thirdly, we can see total quantity with its changing trend over a period of the given variables (here it is total crop production)) by observing the topmost graph line of the band graph.

We thus notice from figure 3 that overall rice is the most dominant crop followed by wheat while Jowar has relatively less production. However it is also observed that from 1981 to 1991 wheat is dominant crop produce followed by Jowar while the production of rice has decreased. This may be because wheat is largely grown twice a year while rice is generally rain fed. Besides, the failure of monsoon affects rice productivity as the crop needs more water. Thirdly with increasing drought situation Jowar is most suitable crop produce as it requires less rain.

#### MAP AND ITS MAIN ELEMENTS:

Map may be defined as "a conventional representation of the earth or its part on plane surface with certain scale". Its main elements are (1) Title / Theme, (2) Scale, (3) Direction, (4) Grid / Co-ordinates of latitudes and longitudes (5) lettering size and shape and (5) Conventional signs and symbols.

 Title/Theme of the map: Any map is drawn (prepared) to represent a particular aspect/theme/topic. The position of the theme of the map is often given at central topmost part of the map in big size bold letters for example: World: Physical Map / World: Political Map / World: Distribution of Population etc.

- **3) Direction**: Direction is also an essential element of map because it helps in locating a particular place or feature with reference to a known point.
- 4) Grid / Co-ordinates of Latitudes and Longitudes: A map is drawn on a plane surface but the earth's surface is actually curved hence, the correct representation of the earth is on a globe and not on plane paper. The construction of map involves the problem of transformation of spherical surface into a plane, which is solved with the help of map projections that yield co-ordinates of latitudes and longitudes. These co-ordinates help to find exact location and extent of any place.
- 5) Lettering size, shape and spacing: Information depicted in the map by words is based on the importance/ ranking/hierarchy of that aspect represented on the map. Hence different size (font) and shape (bold/normal; italic or gothic etc.) of letters are used. For example: World / Continent/ country/ capital place of country/ important cities/ places of historical importance etc. Thus here 'World' will be written in bigger size with bold letters while continent name will be slightly smaller and country name will be still smaller in size etc.
- 6) Conventional Signs and Symbols: A map is a conventional representation of the earth's surface. Various features of the landscape are depicted with the help of conventional signs and symbols on maps. Use of conventional signs and depict maximum information of any given areas on a small piece of paper with clarity and legibility.
- 5) Other Important Elements: The index, the title and subtitle of the map, are the other important elements of the map. These elements are very essential for a good map. In other words, these elements are the backbone of maps.
- **Please Note:** You are requested to observe all these element of a map whenever you are viewing any map. You will then understand these map elements more clearly. It is necessary to quote that Department of Geography, University of Mumbai at Vidyanagari campus, kalina, Santacruz has National map Reference Library that may be visited to see and know different types and aspects of a map.

#### MAP READING

Man-environment relationships with reference to ever increasing population an its complex use of resources, differential levels of development and wide socio-economic disparities; increasing levels of pollution and deterioration of natural resources; scarcity of energy in the world etc. all can be produced through maps. . Geographers predominantly, as well as the planners, historians, economists, agriculturalists, geologists, and others working in the basic sciences and engineering, long ago found the map to be an indispensable aid to study these varying distributions an differences at a glance.

A small map of a large region depicting its physical aspects (land forms-relief, geology, drainage, climate, soils and natural vegetation); and cultural aspects (such as distribution of population, settlement patterns, transport and communication routes, agriculture, industry, historical/religious features etc) make available the information required to plan different policies and implement them more effectively. Ecological complexities of the environment can be easily understood with the help of maps. Any changes in the existing landscape require a detailed study which is possible wit th help of physical maps. For example construction of dam site and creation of water reservoir, Hydel power site / road route, ports, ropeway, airports, industrial location settlements etc, requires maps to be prepared to make development successful. Natural hazards can also be well depicted on the map and precautionary mitigation measures can be adopted to minimize or avoid the losses due to disaster. Besides, potential areas having resources can also be identified and mapped for promoting overall sustainable development. Maps of the whole earth indicate generalizations and relationships of broad earth patterns with which we may intelligently consider the course of past, present and future events.

#### MAP FILLING

Map filling / marking the details on a map is an art of representing spatial distribution of various natural, cultural, economic and social elements on the outline map of the world, continent, country or any region, with the help of conventional signs, colours and symbols.

Generally, such distribution .shown with the help of point (.) location, line ( \_\_\_\_\_) location, or an area ( \_\_\_\_\_) location by using some shades or colours. For example, location of a town, port, industry etc. are point features shown by point location. A river, road, railways, water ways etc. are linear features shown by line location and distribution of rice, wheat, cotton etc. producing regions occupy area and so are shown by areal features and so are shown by areal diagrams.

In map filling use of certain colours for distribution of certain elements is done conventionally. For example, water bodies are shown in blue colour, natural vegetation in green colour, roads, and settlements etc. in red colour, agricultural land in yellow colour, and areas of high altitude in brown colour etc. These colours are used universally by all the countries while representing these common features on the maps.

Use of symbols is used in map filling to show some specific aspects. These can be represented by symbolic pictures for example, for engineering industry a wheel, for automobile industry a sketch of an automobile or for textile industry sketch of chimney and chemical industry sketch of a drum etc.

. Sometimes first letter of a commodity is used to show its distribution. For example, rice producing areas by 'R' or wheat producing areas by 'W etc. Here letter becomes a symbol some time instead of using letter as a symbol.

#### MAPS

Maps are our friends and guides. They provide us useful information in a very attractive manner with the help o conventional signs and symbols. The subject of geography can be well be understood with the help of study of maps. Hence it is important to know methods and techniques used in the map for reading and interpreting the map.

#### Map is a picture of the earth's surface

Pictures, illustrations, diagrams and maps are the visual forms of communication which are far more effective than the words or the verbal communication.

In China, it is said that **'one picture is equivalent to thousand words'.** What you can not communicate in thousands of words can be effectively communicated with only on e picture or map.

Map is considered as the **mine of information** which can be understood through proper map reading and its interpretation.

#### How to remember locations represented on the maps?

- 1) **Direction:** Determine the direction of the map. Generally the top of the map is north and bottom is south, left side is east and right side is west. Middle part is central.
- 2) **Prominent landmarks/ features:** Identify the prominent features on the map. These may be:
- i) **Coastline and ports:** Port locations are generally located near the creeks or headlands along the coast, e.g. Dabhol, Jaigad,

Ratnagiri, Deogad and hence we get small notch or marking along the coastline which represents that creek or headland. (Figure 4.)This peculiar shape' helps us to remember locations.

- ii) Alignment of the places/ Transport routes and major stations/nodes. Some places are aligned in one straight line hence it becomes easy to remember them if you consider their alignment, e.g. Malad Mulund, Andheri Vikroli, Grant Road Sandhurst Road. The dotted lines joining these places are in the east-west direction, or parallel to the X -axis. figure 5
- iii) **Midpoint locations:** Certain places are situated exactly at the mid-point between the other two places, e.g. Harne is midway between Alibag and Ratnagiri.
- iv) **Equal distances:** Distance between Malvan Ratnagiri, Ratnagiri Harne and Harne Alibag appear to be the same on the map or Pophali is at equal distance from Harne and Ratnagiri (Refer to the Mid-point location map) figure 6.
- v) X Y axis locations: If you consider the imaginary X and Y axis from some prominent landmarks then you find that certain places are situated at the point of intersection of \*X' and Y' axis. e.g. Saki Naka is at the point of intersection of "X' and Y' axis drawn on the map of Mumbai. figure 7
- vi) **Capital place/ head quarter:** is generally nodal place of historical significance.
- vii) **Historical place:** Palace/forts/battle fields etc. have unique pattern of settlements. For example on river/coastal island/ confluence of a river, lake, hot spring, hill-top etc.

In relation to these features one may be able to find/locate and remember the places. If you are able to understand and practice these techniques, you will be able to remember place easily and so you will not have problems about the map reading and then you will say **I Love maps**.







**Use of conventional colours in the maps:** Colours make maps more attractive and memorable. Appropriate / representative colours are used to represent various physical and cultural features. These colours are more representative to the features depicted. It is given in table 4. Besides, the density, gradient, distribution effect is represented by the colour-tin (colour-shades) for that feature. For example the depth of water is shown in different tints of blue shade (where shallow water is light blue colour and blue shade becomes darker with increasing depth of water).

Colours play an important role in our life. World appears more beautiful due to the various colours. Colours also convey specific meaning e.g. red colour is used for traffic signal, which means stop or danger. Green means you can cross the road. Similarly on 'Rose day' roses of different colours are used for different purposes. Conventionally following colours are used in the maps.

#### 238

# Table 5.Conventional colours used in map

Colour	Natural	Colour	Cultural /
	features		Man-made
			features
Sky	Water, river,	Yellow	Agriculture
blue	Sea etc.		_
Green	Vegetation	Red	Settlement
	_		s and roads
Brown	Relief	Black	Railway
	features		

# Table 6.Conventional Symbols used in map

Colour	Natural		Cultural	Cultural /
features			Feature	Man-made features
	symbol		Symbol	
Sky blue for perennial	(+) Spring		R.S.	Railway Station
Black	◀_		P.S.	Police Station
	Tidal river			
			P.T.O.	Post and Telegraph Office
			P.H.C	Primary Health Centre
			R.H.	Rest House
			P.F.	Protected Forest
			R.F.	Reserved Forest

**Table 6** represents few conventional symbols used in the map.

Apart from these colours any type of colour can be used in the thematic map by a cartographer (one who is specialized in map-drawing) depending upon the specific purpose of a map.

Children love colouring pictures similarly grown ups like you also like colouring. With this intension, various geometrical shapes (symbols) are used in the maps to represent distribution. You are free to select any appropriate colour for these symbols. Colouring your own map makes the map more attractive and it increases your involvement with the map which enhances knowledge and hence it becomes easy to remember places represented on the map. **B. Distribution Maps:** These maps depict spatial distribution of any phenomenon under study. Different types of cartographic techniques are used for such representations. These are:

1) **Choropleth Map:** are drawn when the quantity specified belongs to a particular administrative unit having its defined boundaries.. For example:

- i) Continent wise distribution of population in the world where continent is a boundary
- ii) Country wise distribution of population in the world where international border is a boundary
- iii) State wise distribution of population in a country where state border is a boundary.
- iv) District wise distribution of population in a state where district border is a boundary
- v) Taluka wise distribution of population in a district where Taluka border is a boundary.

Each of these maps has its own purpose and utility. Accordingly based on the study purpose a particular distribution is adopted as the nature of work, time and cost vary with the type of map used.

These data is generally taken from government published census handbooks. The statistical data of the quantity of a particular element is generally available at different levels ranging from continent/ country/state/district/ Taluka/ town/village level in such government publications. Then a suitable scale, as shown in the index of the map is selected to map the data indicating variation in densities for he given administrative unit with the help of class-groups. The final data is represented on the map with different colours or patterns. In order to differentiate between the densities, it is desirable that the degree of darkness of colour/shade or pattern should be proportionate to the density represented. Generally higher the density darker the colour shade and the shading effect go on decreasing with decreasing density. Such Choropleth maps are also known as the "Density Maps".

However the limitation of the Choropleth maps is it does not give a true picture of the distribution because the density of the element represented is uniform all over the respective administrative unit Figure 8 and 9. In reality such distribution of density is rarely uniform, as water areas, communication lines, steep slopes and peaks are devoid of any settlements.





Figure 8



### Figure 9

**2. Isopleth Maps:** reveal the direction of and degree of extent of variation of a given phenomenon. Isolines are drawn joining the places having same value. These isolines are drawn by deciding a certain interval 9 which is generally uniform interval / class group) by observing th range ( difference between the

highest and the lowest value) in the given data. Isopleth maps are thus drawn to show physical as well human phenomenon. Different names are used to identify these phenomenons as explained below:



A] Physical Phenomenon B] Human Phenomenon

- A] Physical Phenomenon is as under that can be represented by isopleths maps:
- i) Atmospheric Temperature by 'Isotherms' (line joining places having same temperature) figure 10
- ii) .Atmospheric pressure by '**Isobars'** (line joining places having same atmospheric pressure).
- iii) Precipitation/rainfall by isohyets (line joining places having same rainfall amount) **figure 11**.
- iv) Relief height by '**Contours'** (line joining places having same height).
- v) Depth of water is Sea : Line on a marine map or chart joining points of equal depth usually in fathoms below mean sea level is represented by '**Isobaths**'.

#### **B] Human Phenomenon:**

i) **Journey Time by isochrones** (line joining places requiring equal travel time by a particular transport.

ii) **Transport cost by isophores** (line joining places requiring same journey transport cost to transport a particular element from source of supply point to place of destination – industry/go down/market).

iii) **Stages of development by isostades** are the Isolines joining the points of similar stages of development.

WORLD - DISTRIBUTION OF TEMPERATURE

World - Distribution of Average Temperature by Isotherms

figure 10

World - Distribution of Average Rainfall by Isohyets



figure 11

Map of acid rain (figure 12) represents the location, intensity and distribution of acid rain in the world by isopleth map

WORLD - DISTRIBUTION OF ACID RAIN

World - Distribution of Acid Rain) by Isopleth Map

#### Figure 12

The correctness of the isopleth map depends on the isopleth interval. Least the interval most accurate is the representation of the statistical data. In the isopleth map of world distribution of the Acid Rain areas in Europe, N. America and Japan are represented. (Fig. 12) Sometimes the belts between the isopleths are coloured or tinted with a pattern and the degree of its darkness depending on the quantity represented.

3. Dot Map: It is another cartographic technique used for representing distribution of any phenomenon where a particular size of dot is located at that point of place to represent a particular value of that place. For example, distribution of population in a region / state. Location of dots representing distribution of population is done by using base map of that region (basic information). Base map contains the prominent physical and cultural features. Taking these features into consideration that influences the distribution and concentration of population, number and size of dots are placed (located/marked) accordingly on the map. Care is taken that cluster or overcrowding of dots is not preferred in a dot map. It is therefore avoided by using different sizes of dots to represent different values. When the exact figures of the number of cattle, population, area under, some crops etc. are available, the quantitative distribution of these elements can be satisfactorily shown on the map by dot method. In the map given below (Fig. 13) each dot represents 500,000 catties. In the same way the statistics for each country can be collected and the dot map showing the distribution of catties country wise can be prepared. While preparing the dot map, the following factors are generally taken into consideration.

- i) The drawing of state borders is not necessary to show the distribution
- ii) A suitable value of each dot is selected so that the number of dots required for each country will give a sound effect of the distribution of the element. A few dots do not produce a good effect, while too many dots become a crowd.
- iii) A suitable size of the dot is to be selected. All the dots should be of uniform size, iv) While putting the dots on the map one as to keep in mind the physiography and hydrology of the region, because the distribution of the element is more or less governed by the above two factors.



World - Distribution of Cattle by Dot Map

### Figure 14

**4. Flow Maps:** are drawn to represent the relationship between the areas with respect to any phenomenon that involves movement / transfer of living or non-living elements. Flow maps can be drawn into two types:

i) **Ray map:** it represents only the connectivity or flow between the areas. Here the amount transferred is not quantified in the flow map.

**ii) Flow Map:** represents the flow between the areas of people / goods/ services which is quantified. Here the width of the horizontal line (bar) represents the value and the length shows the direction of the areas connected with actual flow. For example movement of crude oil in the world. Flow map helps us to reveal the areas of importance of a region/country at a glance.



Figure 15

Traffic flow cartograms are really very illustrative and at once bring home the vivid picture of business activity or movement of people in the region. They look like the arterial system of our body through which the vital energy continues to flow. This method is also used in atlas maps to show the major shipping routes in accordance with the volume of international trade moving over them.



Figure 16

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