

Geography Notes Part 25

India - Location and Physiography

Location

India is the largest country in South Asia with rich civilization. It has often amazed and intrigued the rest of the world for its capacity for survival and maintenance of its timeless traditions. Its cultural influences had crossed its borders and reached East Asia and South East Asian countries.

It acts as a bridge between developed and developing countries of the world and between the East and the West. India's strength lies in its geography as much as in its culture.

In historical times, India was known as '**Bharat**' and '**Hindustan**'.

The name 'Bharat' refers to the ancient, mighty king Bharat and the name 'Hindustan' is given after the river Sindhu. The Europeans afterwards started referring to this country as '**India**' a derivative of the word '**Sindhu**'. Today, the officially recognized name of the country is India.

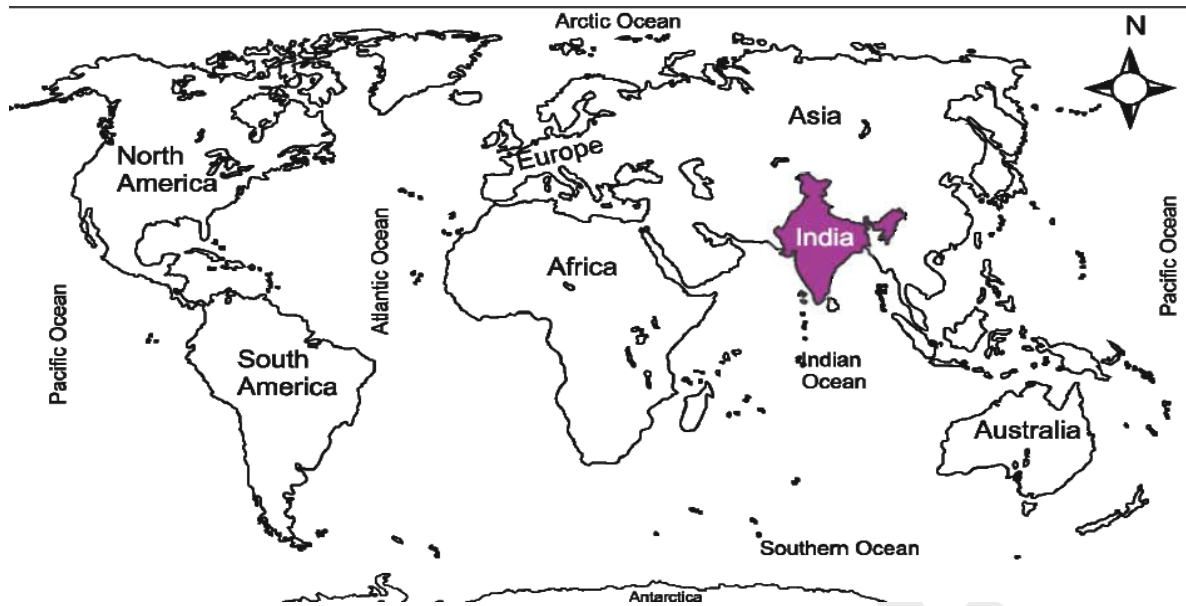
India, a subcontinent

A continent possesses distinct characteristics of diverse,

- 1) Physical features,
- 2) Climatic conditions,
- 3) Natural vegetation,
- 4) Cultural norms,
- 5) Ancient ethnic and linguistic groups and
- 6) Huge area.

All these distinctive continental characteristics are found in India. Hence, we consider India as a subcontinent.

Location of India in the World



Location and Extent

Latitudes and Longitudes help us to locate a place.

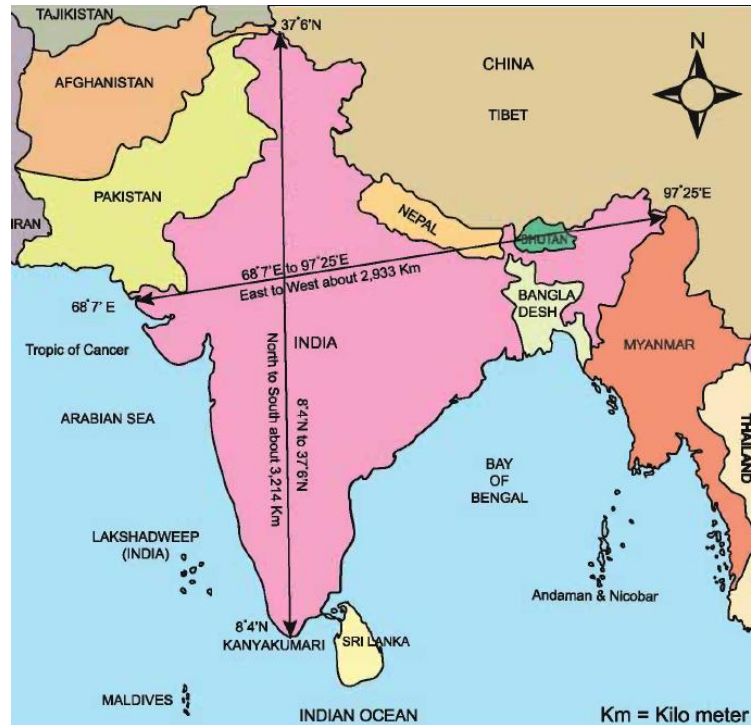
India extends from $8^{\circ}4'N$ to $37^{\circ}6'N$ latitudes and $68^{\circ}7'E$ to $97^{\circ}25'E$ longitudes. The Tropic of Cancer $23\frac{1}{2}^{\circ}N$ runs across the country and divides it into two equal halves.

Tropical and Temperate regions

It covers an area of 32,87,263 Sq.km, with 1.2 billion population (2011 Census). It stretches from **Kashmir** in the north to **Kanyakumari** in the south, for about 3,214 Km and from Gujarat in the west to **Arunachal Pradesh** in the north east for about 2,933 Km. Length of Coastline of Indian mainland is 6000 km. It has coastline of about 7,516 km inclusive of the main land, Lakshadweep, and Andaman and Nicobar Islands.

India's position is favorable for trade, commerce and economic activities by connecting India with Europe through **Suez Canal** and also with China, Japan and Australia through **Malaccan strait**.

India and its boundaries



Remember, The Size of India!

India is the second largest country in Asia; it is 4 times larger than Pakistan, 8 times larger than Japan, 12 times larger than the U.K. but 3 times smaller than the USA.

Indian Standard Time

Longitudes help us to calculate the time of a place. The $82^{\circ}30' \text{E}$ longitude is taken as **Indian Standard Time Meridian (IST)**, as it passes through the middle of India near Allahabad. This is 5 hours 30 minutes ahead of the **Greenwich Mean Time** (0° longitude).

After independence in 1947, the Indian Government established IST as the official time for the whole country,

Do you know the reasons, for following IST?

The east-west extent of India is about 29 degrees of longitude. Due to this great longitudinal extent, the sun rises or sets in the eastern most nearly 1 Hr 56 Min earlier than in the western most part. To avoid confusion with respect to time at different places in India, the almost centrally located longitude $82^{\circ}30'E$ has been selected as standard meridian for the whole country. The local time of this longitude is used as the Indian Standard Time(IST).

India and its neighbouring countries

Palk Strait separates India and Sri Lanka on the South. The Himalayas provide a natural boundary on the north. Arakan mountain range in the east separates India from **Myanmar**. India has the following neighbouring countries. They are:

1. Pakistan in the west,
 2. Afghanistan in the north west,
 3. Nepal, Bhutan and China in the north east and
 4. Bangladesh and Myanmar on the east.
- India is bounded by Arabian Sea in the west and southwest, the Bay of Bengal in the east and southeast and the Indian Ocean in the south. Kanyakumari or Cape Comorin constitutes the southern tip of the Indian peninsula.

The Islands of Andaman and Nicobar and Lakshadweep are the parts of Indian Union situated in the Bay of Bengal and Arabian Sea, respectively.

Unity in Diversity

- 1) India has unique land forms ranging from the highest peaks to the lowest plains.

Which is the highest peak in the world?

Mount Everest is the highest peak in the world, is located in **Himalayas**, in the border of Nepal and China. The

height is **8848 metres** above the sea level.

- 2) **The climate** varies from the tropical to the temperate zone. **Mawsynram** in **Meghalaya** receives the highest amount of rainfall, whereas the **Thar Desert** receives very low rainfall.
- 3) We have wet dense tropical **forest** on the Western Ghats, mangrove trees in the Sunderbans of West Bengal and the shrubs and sparse vegetation in the Thar Desert.
- 4) The diversity of the physical environment and climate has made India an **ideal habitat** for varieties of flora and fauna.
- 5) India is a **secular country** with total freedom of worship. People follow Hinduism, Christianity, Islam, Sikhism, Buddhism, Jainism and

Zoroastrianism with cultural diversities. In spite of its physical, religious and racial varieties, the **‘Indian culture’** unites all people. Hence India is known for her **“Unity in diversity”**.

People shed all their differences and stand together when there is a crisis.

The best examples are Kargil invasions and natural calamities like floods and Tsunami.

We are duty bound to preserve and pass on our rich cultural legacy to the future generations and instill a sense of pride about our identities as Indians.

Political Division

India has been divided into 29 States and 7 Union Territories on the basis of the language for administrative convenience.

Physiography of India

Physiography means the description of physical relief features of a country. India is a land of great physical contrasts. The peninsular plateaus constitute one of the most stable and ancient land block on the earth.

India – Political Division



Information about states					
S.No	States	Capital	Area in sq.km	Population	2011 Population Density/ Sq.Km.
1	Andhra Pradesh	Hyderabad	275045	84665533	308
	Telangana (29)				
2	Arunachal Pradesh	Itanagar	83743	1382611	17
3	Assam	Dispur	78438	31169272	397
4	Bihar	Patna	94163	103804637	1102
5	Chattisgarh	Raipur	135191	25540196	189
6	Goa	Panaji	3702	1457723	394
7	Gujarat	Gandhinagar	196024	60383628	308
8	Haryana	Chandigarh	44212	25353081	573
9	Himachal Pradesh	Shimla	55673	6856509	123
10	Jammu & Kashmir	Srinagar, Jammu	222236	12548926	56
11	Jharkhand	Ranchi	79714	32966238	414
12	Karnataka	Bengaluru	191791	61130704	319
13	Kerala	Thiruvanthapuram	38863	33387677	859
14	Madhya Pradesh	Bhopal	308245	72597565	236
15	Maharashtra	Mumbai	307713	112372972	365
16	Manipur	Imphal	22327	2721756	122
17	Meghalaya	Shillong	22429	2964007	132
18	Mizoram	Aizawl	21081	1091014	52
19	Nagaland	Kohima	16579	1980602	119
20	Odisha	Bhubaneshwar	155707	41947358	269
21	Punjab	Chandigarh	50362	27704236	550

22	Rajasthan	Jaipur	342239	68621012	201
23	Sikkim	Gangtok	7096	607688	86
24	Tamil Nadu	Chennai	130058	72138958	555
25	Tripura	Agartala	10486	3671032	350
26	Uttarakhand	Dehradun	53483	10116752	189
27	Uttar Pradesh	Lucknow	240928	199581477	828
28	West Bengal	Kolkata	88752	91347736	1029
Union Territories					
1	Delhi	Delhi	1483	16753235	11297
2	Andaman and Nicobar islands	Port Blair	8249	379944	46
3	Chandigarh	Chandigarh	114	1054686	9252
4	Dadra and Nagar Haveli	Silvassa	491	342853	698
5	Diu and Daman	Daman	112	242911	2169
6	Lakshwadeep	Kavaratti	32	64429	2013
7	Puducherry	Puducherry	479	1244464	2598

Physiographic Divisions of India

The land forms of India accounts for differences in geological structure. Based on the structure, India is divided into five physiographical divisions. They are:

- I. Northern mountains
- II. Northern Great Plains
- III. Peninsular Plateaus
- IV. Coastal Plains
- V. Islands

I. Northern Mountains

The Northern Mountains are the greatest mountain ranges. The upper slopes of many of the ranges are permanently covered with snow and hence they are known as the ‘**Abode of Snow**’ or the ‘**Himalayas**’. This is the highest mountain range of the world.

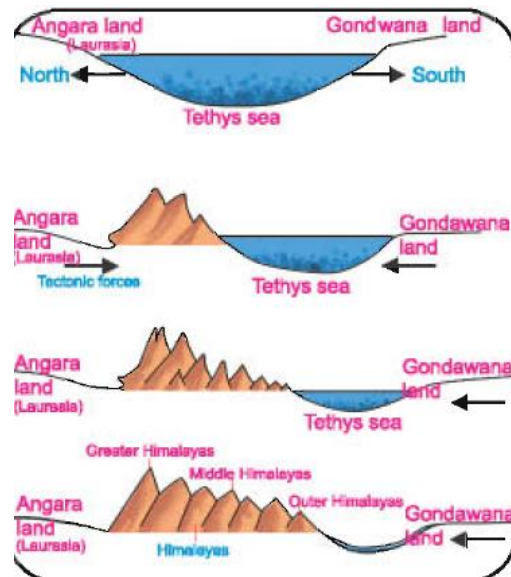
It extends, in the shape of an arc, for a distance of km from the Indus gorge in Jammu and Kashmir in the west and Brahmaputra gorge in Arunachal Pradesh in the east. Many of the ranges rise upto 8000 metres above the mean sea level.

These mountains extend through the states of Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Uttarakhand, West Bengal, Sikkim and Arunachal Pradesh

Formation of Himalayas

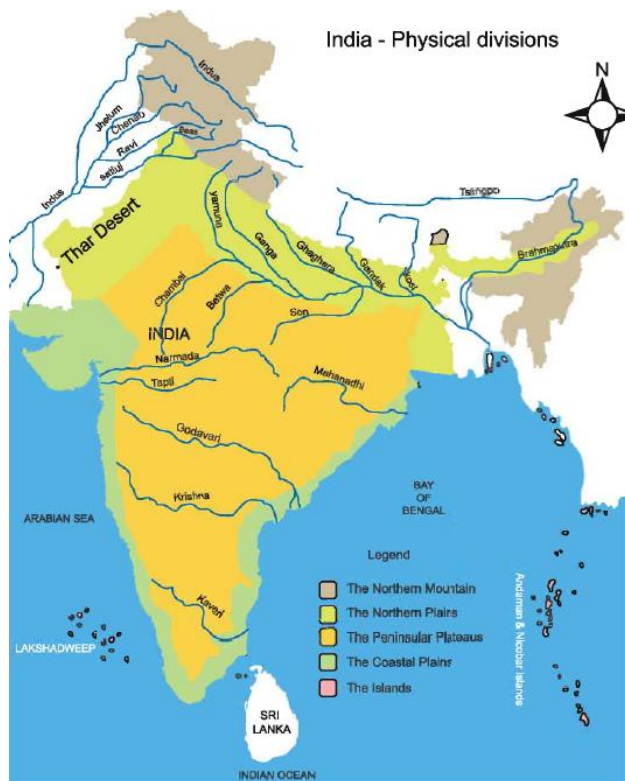
The Himalayas are not a continuous range of mountains but a series of several, more or less parallel or converging ranges separated by valleys and plateaus. Let us see how they were formed.

Millions of years ago, there was only one large land mass on the surface of the Earth and it was surrounded by an ocean on all sides. The landmass was called ‘Pangea’, surrounded by a water body, known as ‘Panthalassa’. This large land mass split up into two parts. The northern part was known as **Angara land (Laurasia)** and the southern part was known as **Gondwana land**. The sea separating these two was called the **Tethys sea**.

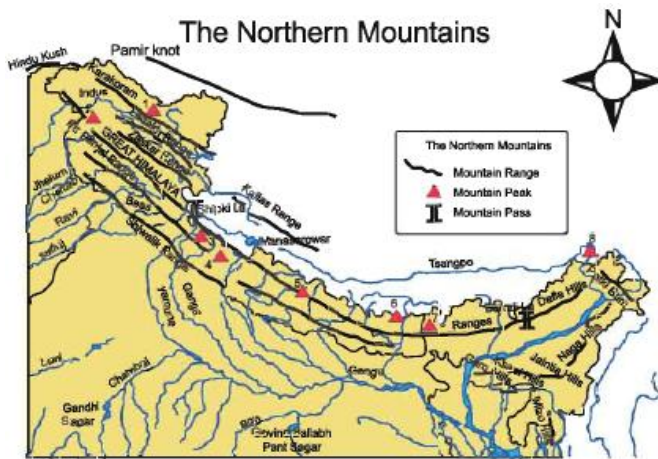


Formation of Himalayas

India- Physical divisions



The Northern Mountains



Mountain Peak

1. Mt. K2 (8611 m)
2. Nanga Parbat(8126 m)
3. Kamet(7756 m)
4. Nandadevi (7817 m)
5. Dhaulagiri (8172 m)
6. Mt. Everest (8848 m)
7. Kanchenjunga (8586 m)
8. Namcha Barwa (7756 m)

This sea stretched towards the east-west direction. The rivers from Angara (Laurasis) and Gondwana deposited their silts along the Tethys Sea. After a long time due to the northward movement of Gondwana land the deposits under the sea were uplifted and formed the Himalayas as fold mountains.

The Himalayas are further subdivided into three parts from west to east. They are:

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

The Western Himalayas are also known as Trans-Himalayas. The lofty

Karakoram Mountains extends eastwards from Pamir Knot, which lies in the North West India. These ranges in the southwest of Kashmir from India's frontier with Afganistan and China. Godwin Austen known as K2(8611 metres), the worl's second highest peak, belongs to this range.

The 'Karakoram pass' has acquired special importance now. **Baltora** and **Siachen** are the two big glaciers, found to the south of Karakoram. There are two parallel ranges, known as the **Ladakh** and **Zaskar**. The extension of Ladakh range is "**Ladakh plateau**", and it is the highest plateau of India. It lies in the northwest of Kashmir.

2. Central Himalayas

The Himalayas, which radiate from Pamir Knot in the southeast direction is called Central Himalayas. There are three parallel ranges found in the central Himalayas from north to south. They are:

- (i) Himadri
 - (ii) Himachal
 - (iii) Siwalik
- i) **Himadri or Greater Himalayas**

Himadri is northern most range of Himalayas. The average height of this range is 6000 meters. It extends from Indus Valley in the north west to Brahmaputra in the northeast. It consists of several peaks of the world. **Mt. Everest** is the highest peak of the world with an altitude of **8848m**. the other peaks of Himadri are **Kanchen Junga(8586m)**, **Nanga Parbat (8126m)**, **Dhaulagiri(8167 m)** and **Nanda Devi(7817 m)**. many glaciers which are source of rivers are found in Himadri. For example, **Gangotri** and **Yamunotri** glaciers are the sources of Ganga and Yamuna rivers, respectively.

'**Passes**' are the natural gaps across the mountains. They provide route to us with neighbours. **Zojila** pass in Kashmir **Shipkila** in Himachal Pradesh and **Nathula** and **Jeblepla** in Sikkim are the most important passes across Himadri.

ii) **Himachal or Lesser Himalayas**

Himachal lies between the Himadri in the north and **Siwaliks** in the south. It extends over a variable width of 80 km in average. The altitude varies from 3700m to 4500 m. It is a highly rugged topography consisting of spurs and dissected uplands. "**Pirpanjal**" in

Kashmir is the longest range of Himachal region. '**Dhaulader ranges**' stretches from Jammu and Kashmir across Himachal Pradesh. Kashmir valley, Kangra valley and Kulu valleys are in between these ranges. The popular hill resorts, Srinagar, Pahelgam, Gulmarg, Mussoorie, Shimla and Nainital are located here. The places of pilgrim interests such as Amarnath, Kedarnath, Badrinath and Vaishnavidevi temples are the assets of the Himalaya; ranges.

iii) Siwalik or Outer Himalayas

Siwalik is the southern most range of the Himalayas. Its average height is 1000m. It is a discontinuous range, made up of mud and soft rocks. The narrow longitudinal valleys called '**Duns**' are found in Siwalik. The best example is '**Dehra Dun**'. Along the foothills of Siwalik, pebbles and gravels are being deposited by the rivers. '**Terai plain**' is made up of deposits of fine silts in the south of Siwalik. It supports the growth of thick forests and marshy lands.

India: Northern plains



3. Purvanchal or Eastern Himalayas

Brahmaputra river marks the Eastern most geographical limit of the Himalayas. These mountains along the Eastern boundary of India is called **Purvanchal**. They comprise of **Patkai hills** and **Naga hills** in the North and the **Mizo hills** in the South.

II. Northern Great Plains

The Northern Great Plains are located at the south of Himalayas. They are formed by the deposits of Indus, the Ganga and Brahmaputra rivers. It extends over a length of 2400km. It covers an area of over 7 lakh sq.km. important characteristics include the soil features such as Bhabar(unasserted sediments) Terai(marshy tract) Bhangar (Older Alluvium) and Khadar (newer alluvium).

The Bhabar lies along the foothills at about 8 to 16km wide. The rivers, coming from the mountains, deposit their load along the foot hills in the form of alluvial fans. The porosity of the deposits is so high that streams sink and disappears in the bhabar tract and flow underground. This area is marked by dry river courses.

The Terai is a marshy tract, where most of the underground streams of the Bhabar belt reappear. The terai belt is located towards the south of the bhabar tract and is about 15km to 30km wide. It is a zone of excessive dampness. It helps the growth of forests and variety of wildlife. Most of the Terai land has been developed into farm lands.

The **Bhangar** represents the alluvial terrace. It is formed by the deposition of older alluvium which lies above flood-limit of the plains. Bhangar is mainly composed of clay.

The **Khadar** is the newer alluvium brought by the rivers. It is deposited in the flood-plains along their banks. It is enriched by fresh deposits of silt every year during the floods.

Northern Plains can be divided into the following regions.

1. Rajasthan plain
2. Punjab-Haryana plain
3. Ganga Plain
4. Brahmaputra Plain

1. Rajasthan Plain

Rajasthan plain is located in the west of Aravalli Range and it extends for about 640kms with an average width of about 300kms. It covers western Rajasthan where two thirds of this region is desert. It is about 300 metres above mean sea level. In general, the eastern part of the desert is rocky, while western part has shifting sand dunes.

This plain is drained by a number of seasonal streams, originating from the Aravalli ranges. **Luni** is an important river of this region. It flows into Gulf of Kutch. In the north of Luni, there is a large area of inland drainage. It has several dry river beds.

How does a river disappear?

Several rivers disappeared during recent geological history. Some have changed their courses and some have disappeared completely. The Saraswati was a mighty river in the vedic and pre-vedic time, but disappeared gradually, due to the advancing desert area. The 'Ghaggar' is believed to be the present day successor of the saraswati river.

There are several **Salt lakes** in Rajasthan plain. The largest is the **Sambhar Lake, (Puskar Lake)** which is located about 65km west of Jaipur.

2. Punjab-Haryana Plains

The fertile plains of Punjab and Haryana lies to the northeast of the Great Indian Desert. These plains extends for about 640km from the northeast to the south west and about 300km from west to east. In the east the **Delhi ridge** separates the Punjab Haryana Plains from the Ganga plain.

The Punjab-Haryana plains are formed by depositional activities of the Sutlej, Beas, Ravi rivers. The southeastern part of the plains, bordering the Rajasthan plain, is sandy and has shifting

sand dunes. The area between Ghaghra and the Yamuna rivers lies in Haryana and forms the Haryana plain. It acts as water-divide (doab) between the Yamuna and the Sultlej River.

What is Doab?

The alluvial tract of land between two adjacent rivers. For example, the plains between the Ganga and the Yamuna.

3. Ganga Plain

The Ganga plain is the largest plain. It extends from the Yamuna river in the west to Bangladesh in the east, covering a distance of about 1500km, with an average width of 300km. It covers the states of Uttar Pradesh, Bihar and West Bengal. The Ganga along its large number of tributaries, such as Ramganga, Gomti, Ghaghra, Gandak, Kosi, Yamuna etc, from the north and Son, Chambal, Betwa etc. From the south, have brought large quantities of sand and silt from the mountains and plateaus and deposited in this vast plain. The general slope of the entire Ganga plain is towards the east and the southeast. The average elevation of the plain is about 200m above the sea level.

Ganga – Yamuna Doab lies in the western part of this plain. The lowlying Rohilkhand is located in the east of the Doab. In the sluggish and most of them keep shifting their courses. This has made the region prone to frequent floods.

The Ganga and the Yamuna rivers are sacred to the followers of the Hinduism. Thus many religious places have developed along the bank of the sacred rivers, such as, Haridwar, Mathura, Varanasi, Allahabad and so on. The religious places have developed into large cultural, educational and tourist centres.

The Kosi river, known as the “Sorrow of Bihar” has shifted its course by about 100km in the recent times.

In the lower part the Ganga and the Brahmaputra rivers divided into several channels to form the largest delta in the world. The lower part of the delta called the **Sundarbans** is covered with thick tidal and mangrove forests. The sea-facing region of the delta has a large number of estuaries, mangrove swamps, sand banks and island.

4. Brahmaputra Plain

The easternmost part of the northern plains is drained by the **Brahmaputra River** and its numerous tributaries. The Brahmaputra River originates in Tibet and is locally known as **Tsangpo** (the purifiers). Before entering India, it cuts through the **Dihang gorge** and enters the Assam valley.

A large numbers of tributaries coming from the Assam hills in the north join the main river and form '**alluvial fans**'. There are large marshy tracts in this area. The alluvial fans have led to the formation of Terai.

III. Peninsular Plateau

The peninsular plateau is located to the south of northern great plains. It is triangular in shape and covers an area of about lakh sq.km. It is surrounded by hill ranges on all sides, such as the Aravalli, Vindhya, Satpura and Rajmahal ranges in the north, the Western Ghats in the west and the Eastern Ghats in the east.

The average height of this plateau varies between 600-900 mts above the mean sea level. The general slope is from west to east, while in the Narmada-Tapti region it is from east to west. The Narmada River divides the peninsular plateau into two unequal parts. The northern part is called the '**Central Highlands**' and the southern part is called the '**Deccan Plateau**'.

A) Central Highland

- 1) **Malwa Plateau** is bounded by the Aravali range, the Vindhya Range and Bundelkhand.

The Chambal river and its tributaries have created ravines in the northern part the plateau.

- 2) The **Bundelkhand** is located towards the south of the Yamuna River and is composed of igneous and metamorphic rocks. In the northern part, the Ganga and Yamuna system have deposited alluvium. The hilly areas are made up of sandstone and granite. Some rivers like **Betwa** and **Ken** have carved out deep gorges.
- 3) The **Baghelkhand** lies to the east of '**Maikala Range**'. It is made up of sandstone and limestone in the west and granite in the east. The central part of the plateaus acts as water divide between the son and the Mahanadhi drainage basins.
- 4) The **Chotanagpur Plateau** is located towards the northeast. It is drained by Damodar, Subarnarekha, Koel and Barakar river systems. The **Damodar River** flows from west to east through the middle of this region. This region has a series of plateaus and hills, such as the **Hazaribagh plateau** to the north of the **Damodar River**, **Ranchi plateau** to the south and the **Rajmahal hills** in the north eastern part.

B) Deccan plateau

It covers an area of about 5 lakh sq.km. It is made up of lava and is covered with black soil. It is bounded by the Satpura and the **Vindhya** ranges in the northwest, the **Mahadev** and **Maikala** ranges in the north, the **Western Ghats** in the west, and the **Eastern Ghats** in the east. The Deccan plateau slopes from west to east. That is why the rivers like Mahanadi, Godavari, Krishna and Kaveri flow eastward and join the Bay of Bengal. The northern part, also known as the Deccan trap is made up the lava rocks and has black regur soils. In the southern part, the **Karnataka plateau** merges with the **Nilgiris Hills**. The **Telengana** plateau is drained by the Godavari. Krishna and Pennaru rivers.

Hill Ranges of Peninsular India

- i) **Aravalli Range** is one of the oldest fold mountain systems in the world.

From northeast to southwest, its extent is about 800km. in the north, the average height is about 400 metres, while in the south it is about 900 metres. **Gurushikhar** (about 1722 metres) in the Abu hills is the highest peak of the Aravalli range. The Aravalli ranges are highly eroded and dissected. It is an example for relic mountain.

- ii) **Vindhya Range** rises as an escarpment overlooking the Narmada Valley, and runs parallel to it in the east-west direction for about 1200km. it is composed of sand stone, lime stone and shale, it acts as a watershed between the Ganga river system and the river systems of south India.
- iii) **Satpura range** lies between the Narmada and the Tapi rivers. It is a series of seven hills and stretches for about 900km. a major Part of the Satpura Range has height of more than 900 meters.

C) Western Ghats

Western Ghats are continuous range of hills running in the North-South direction and from the western edge of the Deccan plateau. Its extent is about 1600km from the Tapi valley in the north upto Kanyakumari in the south. The Western Ghats rise abruptly from the Western coastal plain. That is why on the western side, the rivers flow swiftly and make a number of waterfalls like the Jog falls (270 mts) on the Sharavati River. The slope is gentle towards the eastern side of the Western Ghats and the main rivers like the Godavari, Krishna and Kaveri rise from the eastern slopes and flow east wards and fall into the Bay of Bengal. Thal Ghat, Bhor Ghat and Palghat are the three important passes in the Western Ghats, which provide passage for roads and railways, between the Konkan plains in the west and the Deccan Plateau in the east.

The Eastern Ghats and Western Ghats join at the Nilgiris hills and the highest point is **Goddabetta** (2637m). 'Udhagamandalam', a hill station, lies at the foot of the Doddabetta in the Nilgiris.

In the south of the Nilgiris lies the Palghat gap. It is connecting the coastal plains of Kerala with Tamil Nadu by roads and railways.

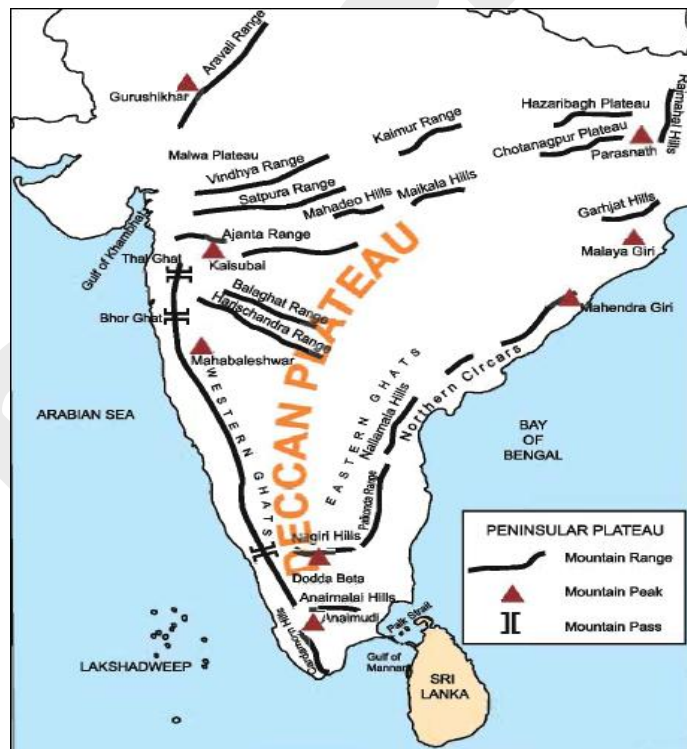
The highest peak of South India is '**Anaimudi**' (2695m) which is the nodal point from which hill ranges, like Anaimalai in the north, Palani in the northeast and cardamom in the south

radiate. The western Ghats terminate about 20km north of cape comorin. Kodaikanal is a hill station which lies in the southern tip of the Palani hills.

D) Eastern Ghats

They run almost parallel to the East coast. These are a series of intersected hills, lying between the Mahanadhi river in Odissa and the Vaigai river in Tamil Nadu. These hills are not continuous and almost disappear between Godavari and Krishna rivers. The Godavari valley divides the Eastern Ghats into the northern and southern parts. The northern part is about 200km wide, while the southern part is only 100km wide. '**Mahendra Giri**'(1501m) is the highest peak in the northern part. In the southern part, the '**Nallamalai range**' is the most prominent. It is composed of quartz and slate. The hills and plateaus in the southern part have low altitude further south the Eastern Ghats merge with the western Ghats at Nilgiris.

Physiography of peninsular India



The peninsular plateau has a number of hill stations such as Udagamandalam(Ooty), Kodaikanal, Yercaud, Pachamarghi(MP), Mahabaleshwar, etc.

IV) Coastal plains

The coastal plains of India are found around the Peninsular plateau. It extends from the 'Rann of Kutch' in the west to the Ganga-Brahmaputra delta in the east, covering a distance of about 6000 Kms. The area between the Western Ghats and the Arabian sea is called the **Western coastal plain**. The area between the Eastern Ghats and the Bay of Bengal is called the **Eastern coastal plain**. The two coastal plains meet each other at **Kanyakumari** the southernmost tip of the mainland of India.

a) Western coastal plains

It stretches from the Rann of Kutch in the north to Kanyakumari in the south.

Except in Gujarat, the Western coastal plain is quite narrow and has an average width of about 65km.

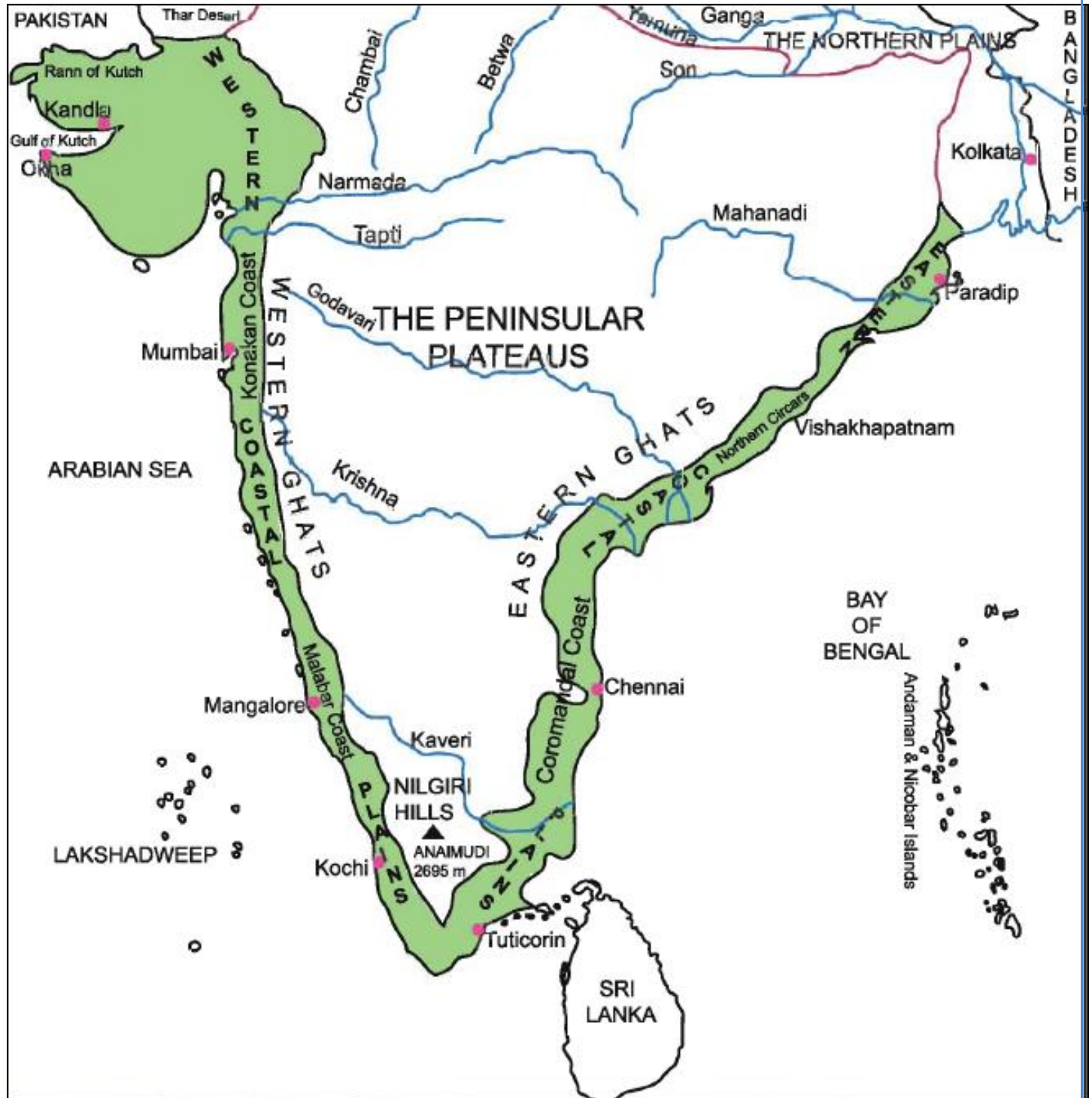
The **Gujarat plain**, lying towards the east of Kutch and Kathiawar, was formed by the Narmada, Tapti, Mahi and Sabarmati rivers which do not form deltas in the west coast. It includes the southern part of Gujarat and the coastal areas of the Gulf of **Khambhat**. It has a chain of saline marshes near the coast, which are flooded during high tides.

The '**Konkan Plain**' lying towards the south of Gujarat, extends upto Goa for a distance of about 500km. Its width is about 50 to 80km. It has features of marine erosion like cliffs, reefs and islands in south of Mumbai. The "**konkan coast**" has series of bays and sand beaches. The northern part of Konkan is sandy while the southern parts is rocky and rugged.

'The '**Karnataka plain**' extends from Goa to Mangalore, and has an average width of about 30 to 50km. At some places, it descends sharply along steep slope and makes waterfalls.

The '**Malabar plain**' lies between Mangalore and Kanyakumari.

Coastal Plains of India



The main characteristics of the Malabar coastal plain are the existence of lakes, lagoons, backwaters, locally called '**kayals**'. Vembanad is the largest lagoon in Kerala. Most of the backwaters are parallel to the coast line. The lagoons and backwaters are linked by canals to provide easy navigation with the help of small country boats.

b) Eastern Coastal Plains

It stretches from the delta region of west Bengal to Kanyakumari. It lies between the Eastern Ghats and the Bay of Bengal. The Eastern coastal plain is more extensive and wider than the Western coastal plain. A major part of this plain is formed by the alluvial deposits brought by the Mahanadi, Godavari, Krishna and Kaveri rivers. The average width is about 120km and it reaches upto 200kms in the deltaic regions. The region has a straight shoreline with well defined beaches such as the **Marina beach** in Chennai. The coastal plain between Mahanadi and Krishna rivers is known as the '**Northern circars**'. The part lying between Krishna and Kaveri rivers is called the '**Coromandal coast**'.

The '**Utkal plain**' is found along the coast of Odisha and extends for about 400km and includes the deltaic region of Mahanadi river. The coast line of Utkal plain is smooth and fringed with sand dunes. **Chilka Lake** the biggest lake in India is located towards the south of the Mahanadi river delta.

The '**Andhra plain**' lies between Berhampur and Pulicat Lake.

It has been formed by the deltas of the Godavari and the Krishna rivers. The Andhra plain has straight coast and has few sites for good harbours. '**Vishakhapatnam**' and '**Machilipatnam**' are notable examples. Kolleru lake is found in Andhra plain.

The '**TamilNadu**' plain stretches from the pulicat lake to Kanyakumari for a distance of about 992 km. its average width is about 100km. the fertile soil and well-developed irrigation facilities have made the Kaveri river delta the '**Granary of South India**'.

V) Indian Islands

There are two main groups of islands in the Indian seas. The **Andaman and Nicobar** groups in the Bay of Bengal and the **Lakshadweep** in the Arabian sea. They are located far away from the coast of the Indian main land. The **Andaman and Nicobar** group of Islands is situated between 6°N to 14°N latitudes and between 90°E to 94°E longitudes. It consists of about 572 big, small and tiny islands, out of which only 38 are inhabited. The total area is about 8249 sq.km. The Andaman Island groups are separated from the Nicobar Island groups by the '**Ten Degree channel**'. The extreme southern most point is the '**Indira Point**.' The Andaman is a closely knit group of islands in which only 25 islands are inhabited. In the Nicobar group only 13 islands are inhabited most of the islands are made up of sandstone, lime stone and shale. Most of them are of volcanic origin, and some are fringed with coral reefs. The islands are mountains with maximum elevation of about 750 metres. Since the climate is hot and humid the area is covered with thick forests and coconut groves.

The Lakshadweep groups of islands are located in the Arabian Sea and have only 27 islands out of which only 11 are inhabited. The Laccadives, Minicoy and Aminidivi group of islands were renamed as Lakshadweep (literally means one lakh islands) in 1973. This islands group is widely scattered over an area of about 110 sq.km. Lakshadweep is located about 200 to 500km south west of the Kerala coast. These islands are of coral origin.

Significance of Indian Physiography

Northern Mountains

- i) The presence of the Himalayas in north prevents southwest monsoon winds and cause rainfall and snowfall. If this mountain is absent, a major part of the Indian sub-continent would have been a dry desert.
- ii) Himalayas forms a natural boundary for the sub-continent. It is permanently frozen and is a barrier to invasion.
- iii) Himalayas forms the sources of many perennial rivers like the Ganga and Brahmaputra.

- iv) Many hill stations and pilgrimage canners are found in the Himalayas.
- v) It provides raw materials for forest based industries.

Northern Plains

The northern plains of India are of great economic and social significance due to their fertile alluvial soils, flat level land, slow moving perennial rivers and a favourable climate, agriculture and trade have been developed.

Peninsular Plateau

Peninsular Plateau is rich in mineral resources and has huge reserves of Iron, Manganese, Copper, Bauxite mica, Chromium, Limestone etc.

Coastal Plains

A large number of big and small ports have been developed all along the coastal areas. These ports play an important role in the growth of national and international trade.

Drainage (Rivers and Lakes)

Rivers, with their tributary systems, are the main channels of drainage of the land surface. Rivers are beneficial to us in many ways. Besides providing water for cooking, washing and bathing, they provide water for irrigation, generation of hydel power, navigation and recreation. They also bring down alluvium from the highland areas and deposit it in the flood-plains and deltas. Alluvial soils in these areas are, therefore, extremely fertile. During each flood, new alluvium is deposited in the lands and fertility of the soil is renewed. Thus rivers are really boon to an man kind.

Birth of a River System

Usually, mountains receive heavy rainfall and hence a majority of rivers originate in mountainous areas. The sheet of water flows down the slope in the form of rills which, after uniting with others, form streams. A number of tributary streams develop to join the main stream at different points along its course. This main stream

Distinction between Himalayan Rivers and Peninsular Rivers	
Himalayan Rivers	Peninsular Rivers
The Himalayan rivers like Indus, Ganga and Brahmaputra originate from the snow-covered mountains.	The Peninsular rivers like Mahanadi, Godavari, Krishna, Kaveri, Narmada and Tapi originate from the peninsular plateau.
These rivers have large basins and catchment areas.	These rivers have small basins and catchment areas.
These rivers flow through deep, nearly I-Shaped valleys.	These rivers flow through broad and shallow valleys.
These rivers are perennial in nature and receive water both from the monsoons and the melting of snow.	These rivers are seasonal as they receive water only from the monsoon rains,
Due to their perennial nature, these rivers are very useful for irrigation.	Due to the seasonal nature, these rivers are not very useful for irrigation.
These rivers are suitable for navigations as they flow over plain areas.	These are not suitable for navigation as they flow over uneven land in the plateau region.
These rivers form large deltas near their mouth like the Ganga-Brahmaputra delta.	The west flowing rivers mostly form estuaries and form smaller deltas.

is known as a river and this stream together with its tributaries constitutes a river system. The drainage system is related to a number of factors for example slope of land, geological structure, amount of volume of water and velocity of water.

Inland Drainage

Inland drainage is found to the west of Aravallis in Rajasthan. Luni is the only river that flows through this region. The river rises to the south-west of Ajmer in the Aravallis. After passing Govindgarh it is joined by the Saraswati, which has its source in lake of Pushkar from this point the river is known as Luni.

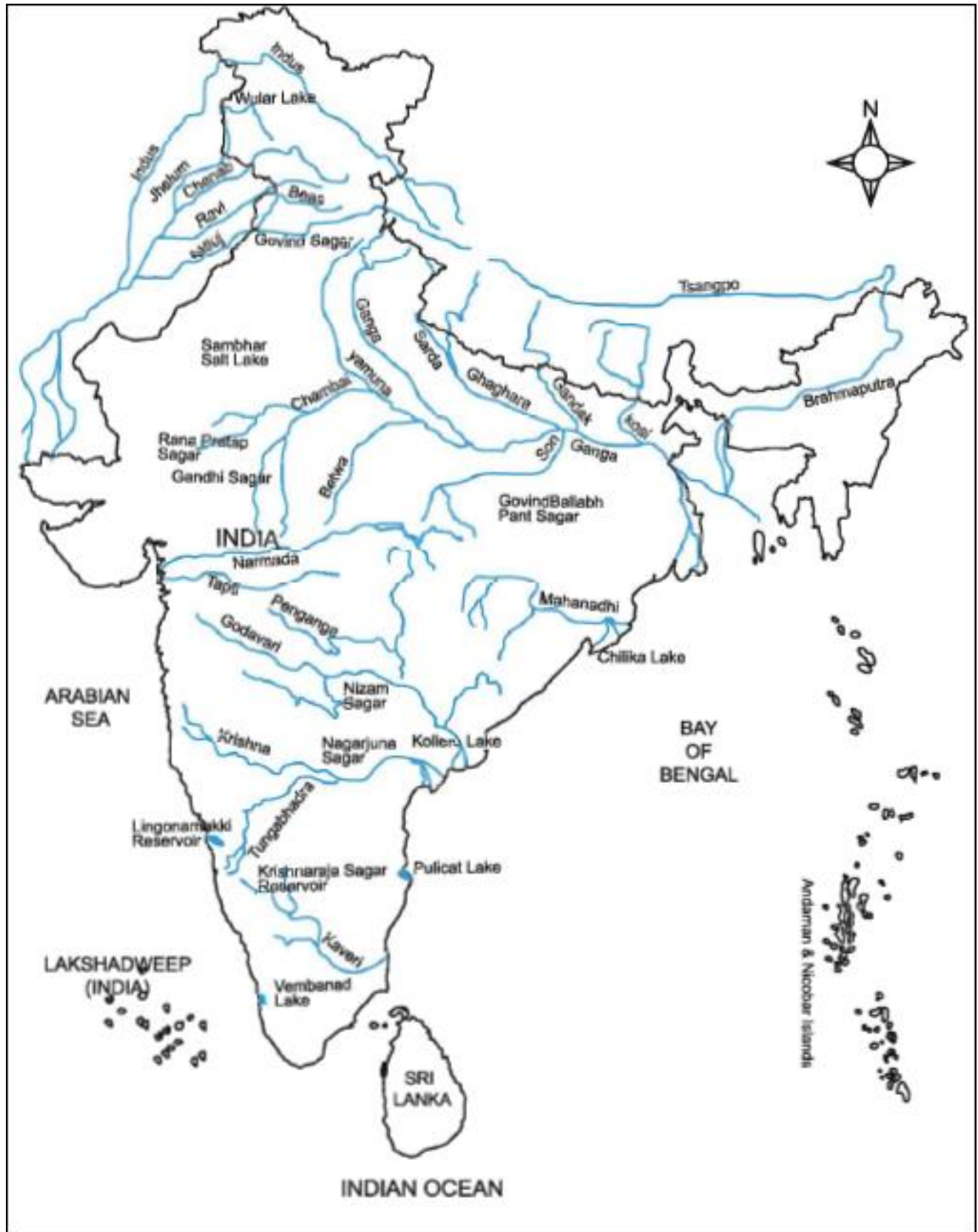
The Luni receives two major tributaries originating from the Aravallis. They are Sukri and the Jawai. After flowing for a distance of about 320km it is finally lost in the marshy ground at the head of the Rann of Kutch. The river is a blessing to the arid parts of southern Rajasthan. As far as Balotra, the water of Luni is generally sweet, but at the Rann it is Saline.

The river system of India is tabulated as follows find the name of the rivers in India and their length, area, origin, end and the places benefitted.

Rivers features

Tributary	A river or stream which contributes its water to main river. For example river Yamuna is the tributary of river Ganga. The Bhavani, Amaravathy and Noyyal are tributaries of river Kaveri.
Distributary	A branch or outlet which leaves a main river and does not rejoin it, carrying its water to the sea or a lake. Ex. Hooghly
Delta	A triangular shaped alluvial tract, formed at the month of a river. For example Kaveri Delta, Ganga Delta. Delta of the Ganga is the largest delta in the world.
Estuary	The mouth of a river where tidal effects are felt and where fresh water and sea water mix; for instance, the Naramada and Tapti Estuaries in Peninsular India.

Indian Rivers



River system of India

Name	Length(km)	Area	Originates from	Ends in	Places benefited
Indus	3100	3,21,290 Sq.Km	In Tibet Range 5080 mts.	Arabian sea	Indian and Pakistan
Ganga(Bhagirati)	2480	3,37,000 Sq.Km	Gangothri	Bay of Bengal	Uttar Pradesh, Bihar, West Bengal
Yamuna(Jamuna)	1370	3,59,000 Sq.Km	Garhwall in Yamunotri	Bay of Bengal	Delhi, Haryana and UP
Brahmaputra	725	2,40,000 Sq.Km	Lake Manasarovar	Bay of Bengal	North Eastern state
Kaveri(Dakshina Ganga" or Ganges of the south)	805	87,900 Sq.Km	Hills of Coorg, Karnataka	Bay of Bengal	Karnataka and Tamil Nadu
Godavari	1465	3,12,812 Sq.Km	Nasik Hills	Bay of Bengal	South-easterly part of Andhra Pradesh
Krishna	1400	2,59,00 Sq.Km	Near Mahabaleshwar in Maharashtra	Bay of Bengal	Maharashtra & Andhra Pradesh
Narmada	1312	98,769 Sq.Km	Amarkantak hill in Madhya	Arabian Sea	Madhya Pradesh and Maharashtra

			Pradesh		
Tapti	724	65,145 Sq.Km	Bettul	Arabian Sea	Madhya Pradesh and Maharashtra
Mahannadi	858	1,41,600 Sq.Km	Amarkantak Plateau	Bay of Bengal	Jharkhand, Chattisgarh, Odisha
Vaigai	240	7000 Sq.Km	Cardaman Hills	Bay of Bengal	Madurai and Ramanathapura m in Tamil Nadu
Periyar	244	5398 Sq.Km	Cardaman Hills	Bay of Bengal	Tamil Nadu and Kerala
Thamiravaruni	123	4400 Sq.Km	Agasthiya Hills	Gulf of Mannar	Thirunelveli in Tamil Nadu

Geography Notes Part 26

India – Climate

Climate is one of the basic elements in the natural Environment. It determines the landforms, soil, vegetation and agriculture of a place. The kind of clothes that we wear, the food we eat and the house in which we live are intimately related to climate. But the climate differs from one place to another place. The sharply contrasting relief features of India create diverse climate. The climate of North India differs from South India in respect to temperature, rainfall etc. Let us have a look at these climatic variations of India with their determining factors.

Can you distinguish weather and climate?

Weather is a day to day conditions of atmosphere at any place in regard to temperature, pressure wind, humidity, and rainfall.

Climate is the average state of weather for a longer period of time at any place. Weather records of a minimum period of 35 years are found necessary to obtain reliable average.

Climate of a place is determined by the following factors such as

1. Latitude
2. Altitude
3. Distance from the sea
4. Wind
5. Position of Mountains

1. Latitude

India lies between $8^{\circ}4'N$ to $37^{\circ}6'N$ Latitudes. $23^{\circ}30'N$ latitude tropic of cancer passes across the country. The parts of the country to the south of tropic of cancer being closer to the Equator, experience high temperature throughout the year. The parts of the country to the north of tropic of cancer on the other hand lie in the warm temperature zone. Hence they experience low temperature particularly in winter. For example New Delhi which is located in $38^{\circ}N$ experiences $23^{\circ}C$ while Kanyakumari at $8^{\circ}N$ experiences $32^{\circ}C$, during the month of November.

2. Altitude

Temperature decreases with increasing altitude from the earth surface at the rate of $1^{\circ}C$ for every 165 meters. Hence, the places situated at the higher altitudes are cooler as compared to places in plains. For example the mean temperature of New Delhi, which is situated in plain region at an altitude of 239 meters from the sea level, is $40.2^{\circ}C$ during the month of June, while the temperature of Simla, which is located in higher altitude of 2205 meters is $23.7^{\circ}C$ at the same month.

3. Distance from the sea

The places to the north of Tropic of cancer experience “**continental climate**”, where the summer is extremely hot and the winter is extremely cold. The prevalence of the climate is due to the far off location from the sea.

The Tropical South, which is enclosed on three sides by Arabian Sea, Indian Ocean and Bay of Bengal. Hence, the coastal areas experience **Equable climate**.

4. Wind

The wind that blows from sea to land is called sea breeze and wind which blows from land to sea is called land breeze; sea breeze is cooler and land breeze is warmer. This is why costal areas experience relatively cooler summers compared to area that lie in the interiors.

Jai Stream

Air currents in the upper layers of the atmosphere is known as Jet streams. It could determine the arrival and departure of monsoon winds in India.

5. Position of Mountains

Position of mountains plays a vital role in determining the climate of any place. For example,

- 1) The great Himalayan range in the North India obstructs the bitter cold winds from central Asia to India.
- 2) The Himalayan range intercepts the rain-bearing southwest monsoon winds, forcing them to shed their moisture, resulting in heavy rainfall in the northeast and Indo-Gangetic Plain.
- 3) The Aravalli range lies parallel to south west monsoon winds and so western side of this range is a desert and receives very less rainfall.

EL-Nino is a complex weather phenomena that appears once in every five to 10 years, bringing drought, floods and other weather extremes to different parts of the world. It is also a cause for the delay of south west monsoon onset in India.

Climate of India

In spite of the great diversity and variation in Indian climate and topography, the most important factor that lends unity to India is the fact of the monsoons. The word '**monsoon**' owes its origin to an Arabic word '**Mausim**' meaning 'season'. The term was used by seamen several centuries ago, to describe 'system of alternating' winds over the Arabian Sea. These winds appear to blow from southwest for six months and from northeast for another six months. The winds which reverse their directions completely between the summer and the winter is known as Monsoon Winds. Due to these monsoon winds, India experiences **Tropical monsoon climate**.

The salient features of Tropical monsoon climate

- 1) The Monsoon winds are classified into Southwest Monsoon and Northeast Monsoon on the basis of the direction from where they blow.
- 2) They are caused due to the differential heating of land and sea.
- 3) The main feature of monsoon winds is change of seasons which determines the climate of India.

Season

On the basis of the monsoon variation, the meteorologists recognize the four distinct seasons in India such as:

- 1) Summer (March – May)
- 2) South west Monsoon.(June – September)
- 3) North East Monsoon (October – November)
- 4) Winter(December – February)

1. Summer (March – May)

The summer season starts in March and continues up to May. During this season the Sun's rays are vertical over the Tropic of Cancer. Therefore the temperature is very high in the northern parts of the India. At some places in northwest India the day temperature may

be as high as 50°C . due to this high temperature, low pressure conditions prevail over northern of India.

Contrary to this the southern part of India has moderate weather conditions because of its locations nearer to sea. The mean maximum temperature here varies from 26°C to 35°C . High pressure develops here due to low temperature comparatively to the north India.

Because of the atmospheric pressure conditions, the winds blow from south west to north east direction in Arabian Sea and Bay of Bengal. They bring pre monsoon showers to the west coastal areas during May. There are few thunder showers called **Mango showers** which helps in quick ripening of mangoes along the coast of Kerala and Karnataka. North Eastern part of India also experiences local storms called '**Norwesters**'. These thunder storms are called as **Kalbaisakhi** (calamity of the months of Baisakh) in Punjab.

Strong hot winds blow during day time over northern and northwest parts of India are called as 'Loo winds'.

2. South West Monsoon(June- September)

After summer season, rainy season starts with the onset of south west monsoon. The high temperature gives rise to low pressure and by the end of May a large area of low pressure is formed over the North West part of the country. At the same time, the oceans become cool and a high pressure area develops over the oceans. We know that wind always blows from high pressure to low pressure. Hence the winds blow from oceans toward the land of India. These winds blow from South East directions. When they cross the equator, they get deflected and blow as South West Monsoon. These winds are moisture laden winds because they originate from Indian Ocean. When they approach the Southern part of Kerala they give rain with violent thunderstorms indicating the onset of the monsoon and lightning. This phenomenon is often termed as the '**monsoon burst**'.

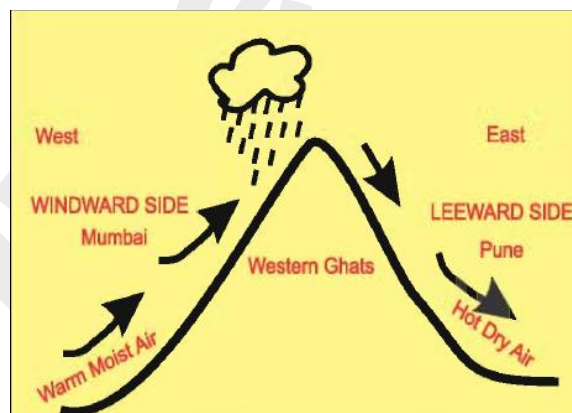
The south west monsoon winds normally divided into two branches because of the peninsular shape of the country. They are Arabian Sea branch and Bay of Bengal branch.

a. Arabian Sea Branch

The more powerful Arabian Sea branch of monsoon wind brings heavier rainfall. Blowing from the Arabian Sea, the first part of the wind first strikes against the Western Ghats. This **moisture laden wind** is forced to ascend the slopes, condenses and gives heavy rainfall to western coastal region. Mumbai gets a heavy rainfall of over 150cms as it lies on the windward side of Western Ghats while Pune gets less than 50cms of rainfall as it lies on the leeward side (rain shadow) of the **Western Ghats**.

The second part of this wind blow through the Vindhya-Satpura ranges and strikes against the **Rajmahal** hills and cause heavy rainfall in the **Chotanagur Plateau** region.

The third part of this wind moves towards Rajasthan where the **Aravalli Mountains** stand parallel to the direction of this wind. Hence it is not able to strike against the mountain and does not any rain to Rajasthan. This is the reason why a part of Western Rajasthan remains to be a desert. This wind then reaches Himachal Pradesh and combines with the Bay of Bengal branch. It gets obstructed by the Shiwalik hills and gives a good rainfall to the foot hills of this region.



Windward side and Leeward side of a mountain

Windward side

The wind striking side of the mountain is called windward side of a mountain, which receives heavy rainfall.

Leeward side(Rain shadow region)

The other side of the mountain which is sheltered from the wind is called Leeward side of the mountain. It receives very less rainfall.

b. Bay of Bengal Branch

This branch of monsoon, blowing from the Bay of Bengal is 'moisture bearing wind'. It strikes against the Kasi, Garo, and Jaintia Hills. This moisture laden wind takes a sudden rise over the funnel shaped hills and causes heavy rainfall in **Mawsynram**, which receives the highest rainfall in India. A part of this branch gets deflected by the Himalayas and moves towards the west giving rain to the Gangetic plains. As it moves further westwards, it loses its moisture content and gives scanty rainfall to Punjab and Haryana. Finally this wind meets the Arabian Sea branch of monsoon wind at the foot hills of the Himalayas and gives heavy rainfall along the Siwaliks. Tamil Nadu remains dry during this period because it lies in the rain shadow area, of the Arabian Sea branch monsoon and it lies parallel to the Bay of Bengal branch.

3. North East Monsoon(October – November)

The South West Monsoon begins to retreat from the Northern India by second week of September because of the apparent movement of the sun towards tropic of Capricorn.

The landmass of India starts losing heat and there is a fall in the temperature. But the sea is still in warm condition. High Pressure develops over the land low pressure over the sea. Therefore wind blows from high pressure to low pressure that is from land to sea. It is cold dry wind and gives no rainfall to land mass. But, when it crosses the Bay of Bengal, it absorbs moisture and gives heavy rain to the

Coromandal coast. So Andhra Pradesh and Tamil Nadu get heavy rainfall during winter. There are frequent **cyclones** formed in the Bay of Bengal and they cause damage to life and property along the Coromandal coast.

Advancing South West Monsoon



The lines shown inside the map denote the advancement of monsoon in our country from 1st day of June to 15th day of July.

India

Retreating North East Monsoon



4. Winter (December – February)

During winter, the sun is overhead in the Tropic of Capricorn. The land Mass becomes cold in North India where the day mean temperature remains below 21⁰C. No obvious difference is found in the temperature during day and night.

In the meantime high pressure develops in the northwestern part of India due to the prevalence of low-temperature. In contrast to this, a low pressure area forms in South India, that is both in Arabian Sea and Bay of Bengal. Consequently the winds blow from the high pressure area of northwest India towards South India. These winds are called the '**Retreating monsoon winds**' which blow from land to sea and do not cause much rain fall. But these winds absorb some moisture while crossing the Bay of Bengal and gives winter rainfall to Tamil Nadu and South winter rainfall to Tamil Nadu and South Andhra Pradesh. This is the main characteristics feature of Retreating monsoon.

During this period, a low pressure depression originates over the Mediterranean across Iran and Afghanistan and reaches India. This low pressure depression is called '**Western disturbance**'. The Jet stream plays a dominant role in bringing this disturbance to India. It causes rainfall in Punjab, Haryana and Himachal Pradesh which is very useful for the cultivation of wheat. It also brings snow fall in the hills of Jammu and Kashmir.

Features of the monsoon

i) Uneven distribution of Rainfall during the year

The South West Monsoon causes over 80 percent of the rainfall over the country during June to September. The normal duration of the Monsoon varies from two to four months. Normally it withdraws from the north-west by the beginning of September and from the remaining parts of the country by the end of October and in some parts of November.

ii) Influence of Mountains

The rainfall is very much influenced by orographic features. Through the wind

passes over Gujarat and Rajasthan, it brings very little rainfall due to absence of mountains. Along the west coast, the winds strike the Western Ghats and bring heavy rainfall on the windward side. For example, The **Shillong Plateau** receives heavy rainfall (annual rainfall at Cherrapunji 1270 cm) while the central part of the Assam Valley which is situated in the lee ward side receives less rainfall(annual rainfall at Guahati 163.7 cm).

iii) Tropical Cyclone

The intensity and distribution of rainfall are determined by a series of **tropical**

Depressions (low pressure systems) which have their origin near the northern part of Bay of Bengal and travel across the country in west and north-westerly direction. On an average, eight such cyclonic depressions may pass from the Bay of Bengal into the land area between June and September.

Cyclone

A cyclone is an area of closed, circular motion of wind rotating in the same direction as the Earth(West to East). This is usually characterized by inward spiraling winds that rotate counter-clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere of the Earth.

iv) Erratic nature of the Rainfall

It is difficult to make any general statement describing the rainfall in any particular state. An area which receives heavy rainfall in one season may experience drought conditions in another season. Sometimes there is a delay in the onset of the monsoons. There may be breaks in the monsoon rain during July and August, sometimes the rain **disappears** for a week or more. The Monsoon may also withdraw earlier than usual or may persist longer than usual.

v) Monsoon rains have great effect on the country's economy

The prosperity of India depends on the success or failure of the Monsoon.

Slight variations in the directions of rain-bearing winds may convert normally well-watered areas into deserts. For example, Gujarat and the Deccan plateau are particularly prone to **drought**. The Hydro electric power plants are affected severely during low rainfall. It leads to shortage of electric supply to the industries and results in great loss of economy.

Rainfall during summer

The annual rainfall varies from about 1187 cm to less than 25 cm. At Mawsynram, a station 16 km west of Cherrapunji in the state of Meghalaya receives 1187 cm rainfall which is the highest in the world. Less than 25cm of rainfall is found in Thar desert in Rajasthan. The erratic nature of monsoon creates havoc at times due to unprecedented rainfall.

Winter Rainfall

Winter rainfall which sets in over the Bay of Bengal in October and meets with the damp winds of the retreating summer monsoon. This current curves round over the Bay of Bengal and blows directly in to the Tamil Nadu coast giving that region the wettest and most disturbed weather of the whole year(mainly during October and November). **Heavy rains** accompanied by stormy winds sweep over the coastal regions causing widespread damage to standing crops and disorganizing means of transport.

Similarly, **Nagapattinam** receives an average of 100 cm out of its total rainfall of 140 cm in the cold season. The rainfall is higher along the coast than in the interior. It decreases rapidly on land so that over the **Mysore Plateau** in Karnataka receives only about 3 or 4 cm.

Distribution of Rainfall

The distribution of rainfall over the country, as we have noted earlier, is determined by two main factors. These are: (1) the **direction** of the rain bearing winds and (2) the **position** of the mountain ranges.

Due to these factors about 30 per cent of the area of our country receives from 15 to 80 cm; 40 per cent receives from 80 to 120 cm; 20 percent gets from 120 to 180 cm about 10 percent receives over 200 cm.

On the basis of the amount of rainfall our country can be divided into four rainfall regions as follows:

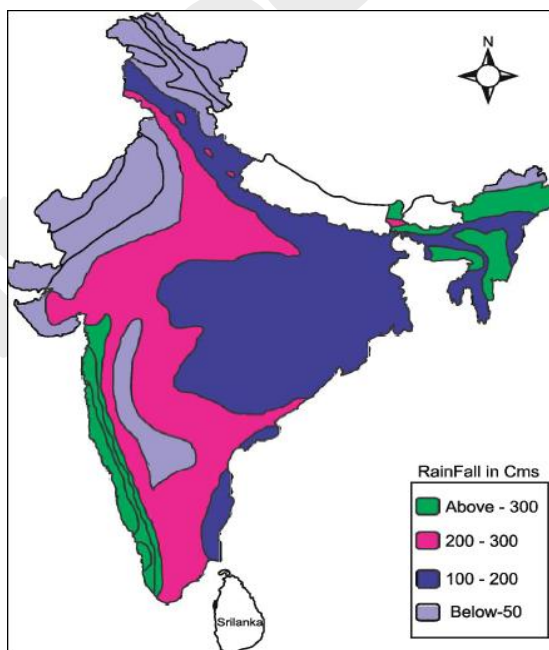
1. Region of very heavy rainfall

Areas with over **300 cm** of rain are the southern slopes of the Eastern Himalayas, Assam, Bengal and the West Region comprising the Konkan and the Malabar Coast.

2. Regions of heavy rainfall

Areas with rainfall between **200 and 300 cm** are the Middle Maharashtra, Madhya Pradesh and Odisha.

India Rainfall Regions



3. Regions of moderate rainfall

Areas with **100 to 200 cm** of rainfall are the Upper Ganga valley,

Eastern Rajasthan and Punjab, Southern Deccan comprising the plateau regions of Karnataka, Andhra Pradesh and Tamil Nadu.

4. Regions of Scanty rainfall

Areas with **less than 50 cm** are the northern part of Kashmir, western Rajasthan, southern Punjab and regions of the Deccan in the rain shadow of the Western Ghats.

Water Management

Water management implies making the **best use** of available water resources for human benefit, while not only controlling its **depletion** and **degradation**, but also for our future needs.

Water is an indispensable resource and has multiple uses. Therefore, it becomes extremely important to manage our soil and water resources in an **integrated manner**. Water management must be under taken at all levels.

The basic requirements for water conservation activities are:

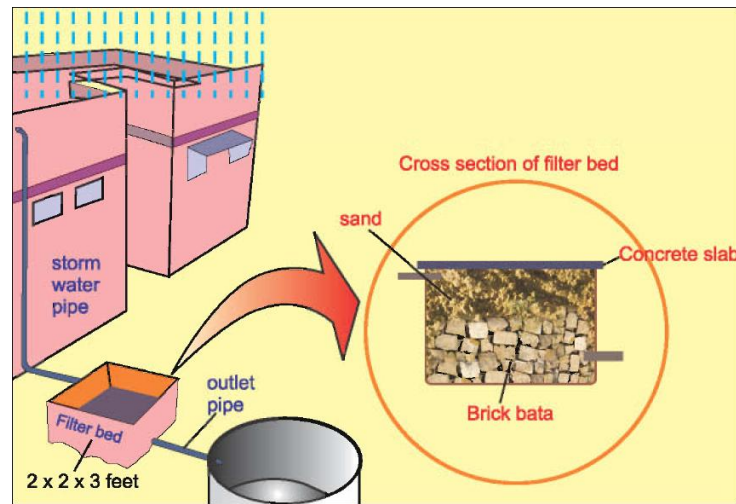
- 1) The total involvement, co-operation and participation of all **local people**.
- 2) All the family members should know the importance of managing household water.
- 3) The most important aspect in water conservation is to treat water as economic commodity and to use it judiciously.
- 4) In the distribution of this economic (commodity) good both **equality** and **quality** must be ensured.

We can save the water through “**rainwater harvesting**” strategy.

Rain Water Harvesting

India experiences Tropical monsoon type of climate. It gives a seasonal rainfall. It is not uniform and is highly erratic. Most of the time the rainfall is scanty, hence it is necessary to save available rain water. We must allow this water to penetrate into deep water table and tap this water when it is needed. In order to prevent surface run-off we must harvest the rain water for future domestic related and other activities.

Rain water harvesting



Hence Rain harvesting is an activity of direct collection and storage of water for our purpose or it can be recharged into the ground for withdrawal later. Through rain harvesting we can understand the real value of rain to make optimum use of it.

Geography Notes Part 27

India – Natural Resources

Natural resources are an essential requirement in our daily life. The economic prosperity of a country depends, to a great extent, on the availability of rich and diverse natural resources. But these resources need to be used judiciously as over-exploitation will lead to serious environmental degradation and resource depletion. Let us now take a look at India's some of the most important sources of natural wealth and understand why we need to conserve them.

Natural Resource

“All materials obtained from the nature to satisfy the needs of our daily life” is known as Natural resources. Land, Air, Water, Sunlight, Soil, Minerals coal, Petroleum, Plants. Animals are some of the examples for natural resources. Human beings use these resources either directly or indirectly for their survival.

Natural Resources can be broadly classified into two types:

1. Renewable resources
2. Non-renewable resources

1. Renewable resources

A renewable resource is an organic natural resource that can replenish in due time, either through biological reproduction or other naturally recurring processes. Renewable resources are a part of Earth's natural environment and the largest components of its ecosystem. For example agricultural crops, take a short time for renewal.

2. Non-Renewable resources

“Non-Renewable resources are resources that cannot be replaced again after utilization”. They are formed over a very long geological period. Minerals and fossil fuels are included in this category. Since their rate of formation is extremely slow, they cannot be renewed easily for example coal and petroleum. That is why we are often advised to use these non-renewable resources judiciously.

Soil Resources

Soil is the most important renewable natural resource. It is the **medium** of plant growth and supports various types of living organisms on the earth.

Soil is the loose material which forms the upper layer of the earth. It has no definite and constant composition. It consists of

1. Decayed Plants
2. Animal substances
3. Minerals like Silica, Clay, Chalk and so on
4. Organic matter called Humus.

Soil Fertility

Soil fertility refers to the amount of nutrients in the soil, which is sufficient to support plant growth.

Soil fertility is determined by the presence of ‘**micro nutrients**’ and ‘**macro nutrients**’ in the soil.

Micro nutrients like sulphur, chlorine, copper, manganese, molybdenum, boron, Iron, cobalt, zinc. Macro nutrients like nitrogen potassium and phosphorous should be contained in the soil. The fertility of the soil increases with the increase of humus content. Humus is the dark organic material in soils, produced by the decomposition of plants and animals matter and essential for the fertility of the soil.

Distribution and characteristics of Indian soils

Soils of India are divided in to six categories as follows: 1. Alluvial Soil, 2. Black Soil, 3. Red soil, 4. Laterite Soil, 5. Mountain Soil, 6. Desert Soil

1. Alluvial Soil

Alluvial soil consists of sediments deposited by rivers along the river course, flood plains, delta and coastal plains. It contributes the largest share to the agricultural production of India.

Alluvial Soil is divided into two types they are 1. Khadar 2. Bhangar.

Khadar is the newer alluvium of sandy, light coloured soil, whereas Bhangar is the older alluvium of more clayey soil. The alluvial soil differs greatly in texture. It is suitable for the cultivation of rice, Wheat, sugarcane, cotton and oil-seeds. In the lower Ganga- Brahmaputra valley they are useful for jute cultivation. In this valley the alluvial soils are brought by the Sutlej, Ganga, Yamuna, Gandak, Ghaghra and other rivers. The parts of **Punjab, Haryana, U.P, Bihar** and **West Bengal** are located in this Valley have alluvial soils.

Mahanadi, Godaveri, Krishna, Kaveri rivers deposit alluvial soil along their courses.

2. Black Soil

Black soil is formed from the weathering of **igneous rocks**. It is found in the valleys of the Godavari, Krishna, Narmada and Tapi. The soil is deposited at about six meters depth. They vary in colour from deep black to chestnut brown. It is fine-grained and generally rich in lime, iron, potash, alumina, calcium and magnesium carbonates, but lack in phosphorus, nitrogen and organic matter. It has a special property of **holding moisture**. Hence it is suitable for the cultivation of Virginia tobacco, oilseeds like linseed, sunflower, fruits and vegetables.

Black soil is more suitable for the cultivation of cotton, rice, wheat, jowar, millets, sugarcane.

Black soil is also found in the Deccan trap, comprising the greater part of Maharashtra, Gujarat, part of Madhya Pradesh, Andhra Pradesh and southern districts of Tamil Nadu.

3. Red Soil

Red soil is formed from the weathering of the ancient crystalline and metamorphic rocks. The red colour is due to its very high **iron content**. The colour varies, from brown to yellow. This soil is **porous** and not retentive of moisture. It is generally poor in lime, nitrogen, phosphorus and humus but when suitable fertilizers are added, it becomes rich in fertility. Wheat, rice, cotton, sugarcane and pulses are grown in this soil.

Red soil covers in most parts of Tamil Nadu, southern Karnataka, Goa, North-eastern Andhra Pradesh, Madhyapradesh and Odisha.

4. Laterite Soil

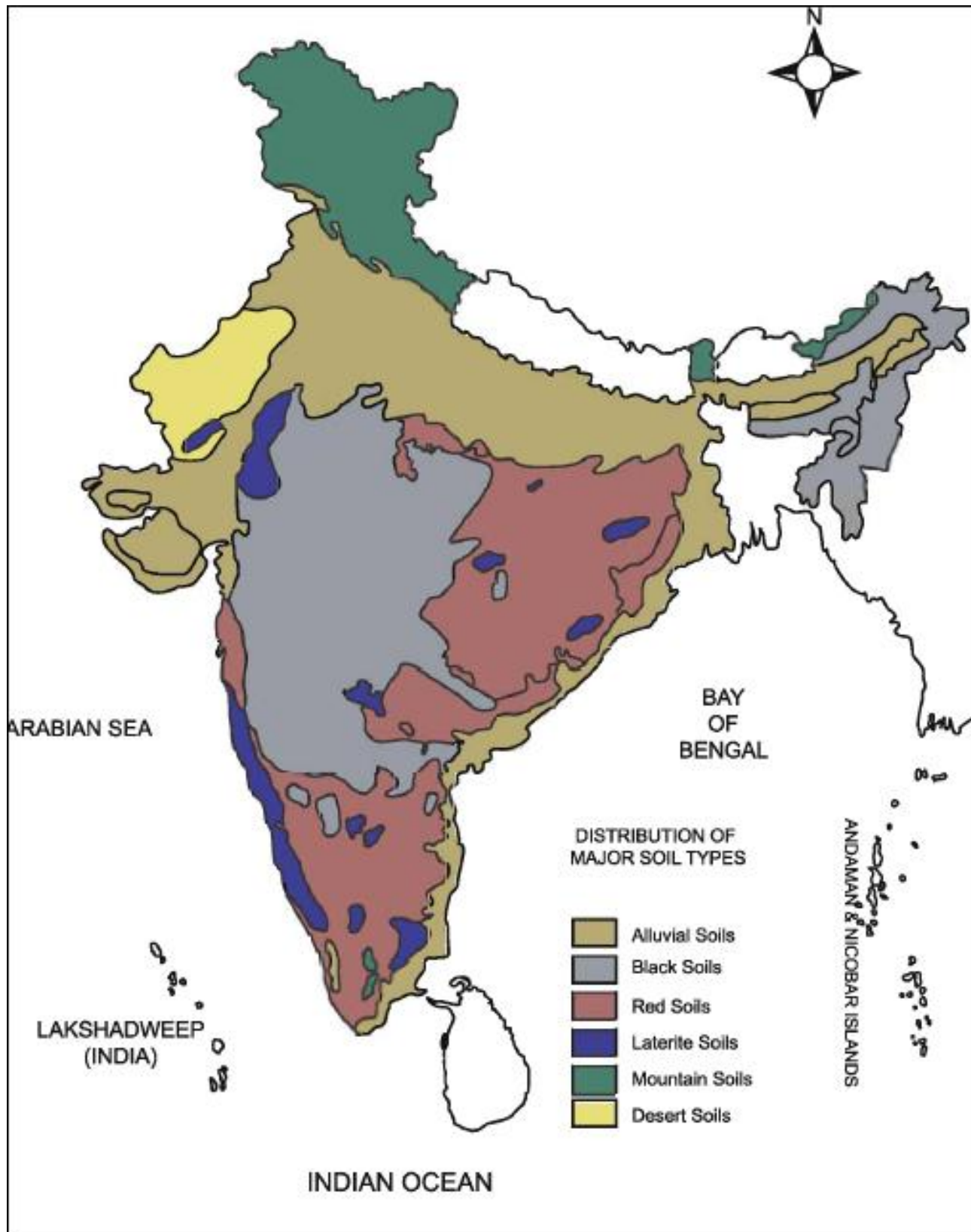
Laterite soil formation takes place under typical monsoon conditions. It is mostly found in **peninsular plateau** of India.

Laterite is a porous soil from which the silica has been removed by chemical

action(leaching). It is coarse in texture and red in colour owing to the presence of **iron oxides**. The crops like coffee, Rubber, Cashew and tapioca are cultivated in this soil.

Laterite is found in Andhra Pradesh, Tamil Nadu, Karnataka, on the summits of Eastern Ghats and Parts of Odisha, Kerala and Assam.

Soil types of India



5. Mountain Soil

This soil is found in the mountains regions such as Western and Eastern Ghats, the Himachal and Siwalik regions. This soil very rich in humus and Organic matter. Plantation crops such as tea, coffee and rubber grow well. Assam and West Bengal in Eastern Himalayas are principal growers of tea.

6. Desert Soil

Desert soil is found in arid zone of the north-western part of India, Rajasthan, Gujarat (Kutch region) and south Punjab.

It is sandy, alkaline and porous in nature. Though it is **highly infertile**, Crops are cultivated with the help of irrigation in some areas. Crops grown are wheat, rice, barley, grapes and melons.

Soil Erosion

Soil erosion means “removal of fertile content from the soil by nature and man”. The proper use of soil resources has become a matter of importance to all of us, because it directly **affects** our food production. Running water, wind, and human beings are the principal contributing factor of soil erosion. In many parts of our country, for instance, in UttarPradesh, Rajasthan and the Deccan vast areas have been devastated by soil erosion.

The nature of soil erosion depend much upon the **texture** and **structure** of the soil. It also depends on the conditions of climate, slope, methods of cultivation and several other factors.

Soil Conservation

Soil conservation is an effort made by man to prevent soil erosion in order to retain the fertility of soil. It may not be possible to stop soil erosion entirely. But steps can be taken to reduce the rate of erosion by taking preventive measures.

The following are some of the preventive measures:

- 1) Construction of dams or check dams across the river course.

- 2) Step cultivation will prevent soil erosion.
- 3) Bunds should be constructed according to contours.
- 4) Excessive grazing should be avoided
- 5) Trees reduce the force of strong winds and prevents blowing away of soil particles.
- 6) Roots of trees plants and grasses hold soil particles and strengthen the soil. Hence deforestation should be avoided to increase forestation.
- 7) Plants, grass and shrubs control the speed of flowing water. Therefore such plants should not be removed. Steps should be taken to plant the trees wherever it doesn't exist.
- 8) Avoiding application of chemical fertilizer and applying natural manure successively to the field is one of the best methods of soil conservation.

Natural Vegetation

Natural vegetation is the vegetation or plant cover naturally grown on the earth's surface. It is a result of climate, soil and biotic influences. The forest is one of the greatest natural resources available to human beings. Yet they have declined through centuries, vast areas of forest have been cleared for cultivation of crops due to over population. This phenomena should be controlled for sustainable development of forest resources.

India's Forest Resources

India's forest resources are unique in nature because there are a large number of species of plants, ranging from drought-resisting thorny shrub to tropical evergreen forests. The total forest area is around 68 million hectares. The percentage of forests in total area of India is 20%, which is considered rather low when compared to the forest areas in most of the countries of the world. However, even this forest area is not evenly distributed; some states have 60 per cent area under forests while other states have only 3 per cent.

The fast shrinkage in forest area is mainly due to the growth in population which due to the growth in population which leads to increasing demands for agricultural land, urbanization, industrialization and new town ships.

Types of Natural Vegetation

The geographical factors which control the growth of natural vegetation in India are temperature, rainfall, topography and soil. On the basis of the above factors, the natural vegetation of India can be divided into following six types. They are:

- 1) Tropical evergreen forests
- 2) Tropical Monsoon forests
- 3) Shrub and Thorn forests
- 4) Desert vegetation
- 5) Mangrove forests and
- 6) Mountain forests.

1. Tropical Evergreen forests

The tropical evergreen forests are found in the regions where the annual rainfall is more than 200 cm. the trees in these forests are evergreen. These forests are very dense composed of tall trees reaching up to the height of above 60 metres.

The important trees of these forests are Rose wood, Ebony, Mahogany, Rubber, Cinchona, Bamboo and Lianas. Due to dense growth of trees, the sunlight cannot reach the ground. Thus. The under growth mainly consists of, bamboos, ferns and climbers.

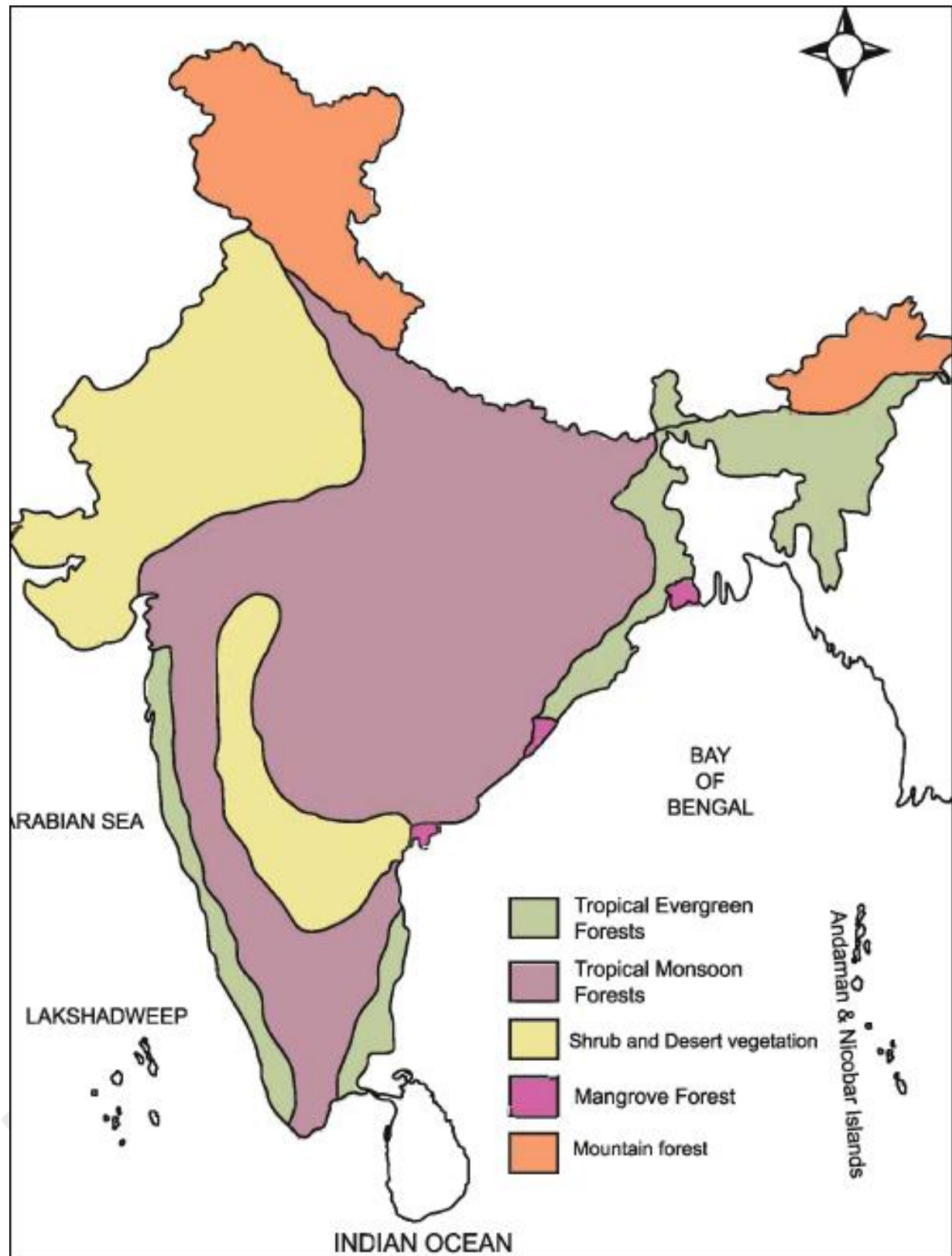
The evergreen forests are mostly found along the western side of the Western Ghats, Andaman and Nicobar Islands, lower slopes of Himalayas and some parts of Assam and Odisha.

2. Tropical Monsoon Forests

These are the typical monsoon forests and are found mainly in those area where the average annual rainfall ranges between 70 cm and 200 cm. The trees in

India

Natural Vegetation



the deciduous forests shed their leaves due to dryness for about 6 to 8 weeks during the spring and early summer. Hence these forests are called **deciduous forests**.

The tropical deciduous forests are commercially most important as they yield valuable timber and variety of other forest products. The main trees are Teak, Sal, Sisam, Sandal Wood, Wattle and Neem.

The tropical monsoon forests are commercially most exploited. These forests have also suffered due to over-cutting, over grazing and fire. The moist monsoon forests are found mainly in the North-eastern states, along the foot hills of the Himalayan Mountains, Jharkhand, West Odisha, Chattisgarh and on the eastern slopes of the Western Ghats. The dry monsoon forests are found on the peninsular plateau, plains of Bihar and Uttar Pradesh.

3. Shrub and Thorn Forests

These forests are found mainly in those areas where the average annual rainfall is less than 75 cm with the long dry season. The trees are scattered in these forests. They have long roots to tap water in the underground. They have thick and small leaves which retards evaporation. They have thorny thick bark.

The main trees are Acacia, Palms and Cacti. Other important trees include Khair, Babul, Palas, Khagri, and Kajuri.

It is mainly found in the north western part of the country, including semi-arid areas of Gijarat, Rajasthan, Madhya Pradesh, Uttar Pradesh, South Western Punjab and Western Haryana. These forests are also grown on the leeward sides of the Western Ghats, covering large areas in Maharastra, Karnataka, Andhra Pradesh and Tamil Nadu.

4. Desert Vegetation

It is found in regions where the rainfall is less than 25 cm.

The vegetation mostly consists of thorny bushes, acacias, wild berries and babul. These trees are 6 to 10 meters high but they have long roots and are armed with

hard thorns to protect themselves from animals.

The babul yields gum and its bark provides material for tanning hides and skins. These are found in Rajasthan, Kutch and Saurashtra in Gujarat, south-western Punjab and parts of the Deccan.

5. Mangrove Forests

Mangrove forests are found in coastal areas flooded by the tides of the sea.

Some of these forests are dense and impenetrable. The trunks of these trees are supported by a number of roots which are under water at high tide. At low tide, their roots can be seen. They are found in great abundance in the deltas of the Ganga, Mahanadhi, Godavari, Krishna, and Kaveri and along the coasts of the Andaman Islands.

They are also found along the west coast in a few places. In West Bengal they are called **Sundarbans**. These woods are hard, strong and durable and are used for boat building. These forests are a valuable source of fuel.

6. Mountain Forests

The natural vegetation in the mountains is greatly influenced by the decrease of temperature with increase in height above sea level. The mountain forest can be broadly classified into two major categories:

1. The forests in the Himalayan ranges.
2. The forests in the Peninsular Plateau and hill ranges.

In the Himalayan mountains, the forests are found between the heights of 1000m and 2000 m. The ever green broad leaf trees such as Oak, Chestnut predominate. Between the height of 1500 m and 3000 m, the coniferous trees such as Pine, Deodar, Silver fir, Spruce and Cedar are found. The coniferous forest cover the southern slopes of Himalayas and parts of North East India. At an altitude of above 3600m, Coniferous forest and grass lands give way to

Alpine vegetation. Silver fir, Junipers, Pines, Birches are common varieties of trees. At higher altitudes, mosses and lichens form part of vegetation.

In the peninsular India, the mountain forests are found in three areas. They are:

1. Western Ghats
2. Vindhya
3. Nilgiris

In Nilgiris, the tropical forests are locally called '**sholas**'. Such forests are also found in the **Satpura** and **Maikal ranges**. The important trees in this region are Magnolia, Laurel, Cinchona and Wattle.

Grass Lands

Though the Indian grasslands are not comparable to the savanna or steppes grasslands, they do occur on wet soil ground and in the salt belt and some hilly areas. They are sub-divided into two categories.

1. Low-Land Grasses

These are found in regions receiving 30 cm to 200 cm of average annual rainfall where the temperature is high during summer. These grasses are found on different soils and are suitable for cattle-breeding. They are found in the plains of northern India, Punjab, Uttar Pradesh, Haryana, Bihar and Northwest Assam.

2. Upland Grasses

They are found at a height of over 1000 m in the Himalayas and in the cleared forest areas of the Western Ghats in Karnataka region. They are found among small tracts of shoal forests in the southern part of India too.

Importance of Forests

1. Forests provide **valuable timber** for domestic and commercial use and raw materials for industries.
2. It supplies a number of **products** such as Lac, Gum, Resins, Tanning materials, Medicines, Herbs, honey and Spices.
3. Export of forest products earns valuable **foreign exchange**.
4. Grazing cattle in the forests helps in **dairy farming**.
5. Many forest reserves have been developed into **tourist centres**.
6. Forests absorb atmospheric carbon-di-oxides and help in controlling **air pollution**.
7. Forests help in controlling **soil erosion**, land reclamation and flood control.
8. Forests helps in water percolation and thus maintain **underground water table**.
9. Forests provide **natural habitats** to primitive tribes, animals and birds.
10. Forests are the **moderators** of climate and affect temperature, humidity and rainfall.
11. Forests meet nearly 40% of the **energy needs** of the country.

In India, much of its forests and wild life resources are maintained by the Forest Department. They are classified as follows:

Reserve Forests

About half of the total forest land has been declared as reserved forests. It is also known as **permanent forest**, it is regarded as the most valuable as far as the conservation of forest and wild life resources are concerned.

Protected Forests

Almost one-third of the total forest area is protected forest, as declared by the Forest Department. Here, felling trees are not allowed.

Forest Conservation and Management

The increasing destruction and degradation of forests have led to extensive soil erosion, uncertainly in rainfall and recurring floods. The Forests conservation Act of 1980 was formulated especially to check deforestation of forestlands for non-forestry purposes. In 1988, the act was

amended by prescribing severe punishment to violators. The government should involve village communities and voluntary agencies for the **regeneration** of degraded forest land.

National Forest Policy

India is one of the very few countries in the world, where a policy to conserve forests was developed in 1854. It was modified and updated in 1952 and 1988.

The main objectives of the policy

1. Bring 33 percent of the geographical area under forests(now it is 20% only)
2. Maintain environmental stability where ecological balance was disturbed.
3. Conserve bio-diversity of the country.
4. Check soil erosion, extension of desert land and reduction of floods and drought.
5. Increase forest cover through social forestry and farm forestry.
6. Increase productivity of timber, fuel, and fodder from the forests.
7. Involve women to encourage planting trees and stop felling of trees.

Thus, it is our prime duty to conserve our country's natural vegetation.

Mineral Resources

The minerals are broadly classified into two. They are:

1. Metallic minerals
2. Non-metallic minerals

1. Metallic Minerals

The metallic minerals contain metals such as Iron, Copper, Manganese, Bauxite and Gold. They are further divided into ferrous minerals and non-ferrous minerals.

2. Ferrous minerals

Minerals having more iron content are called **ferrous minerals**. For example, Iron, Manganese, Nickel, Cobalt, and Tungsten.

Non-Ferrous Minerals

Minerals which do not have iron contents are called as **non-ferrous minerals**. For example Gold, Silver, Copper, Bauxite.

Non-Metallic Minerals

The non metallic minerals are minerals which do not contain metals, such as Mica, Lime Stone, Gypsum, Potash, Coal, etc. example : Coal and Petroleum.

Some important minerals

Iron ore

Iron ore is the **basic resource** for a nation's development. Iron is described as the back bone of civilization. India possesses 20% of the iron deposits of the world's total reserves.

It is the second largest after the reserves of Russia. The quality of Indian ore is very high. Iron producing areas in India are Durg in Chattisgarh, Singhbhum districts in Jharkhand, Mayurbhanj, Keonjhar and Sundergarh district in Odisha and other areas are Goa, Karnataka and Tamil Nadu.

Manganese

India occupies fifth position in the production of manganese. It is estimated that about 20% of the manganese deposits of the world are in India.

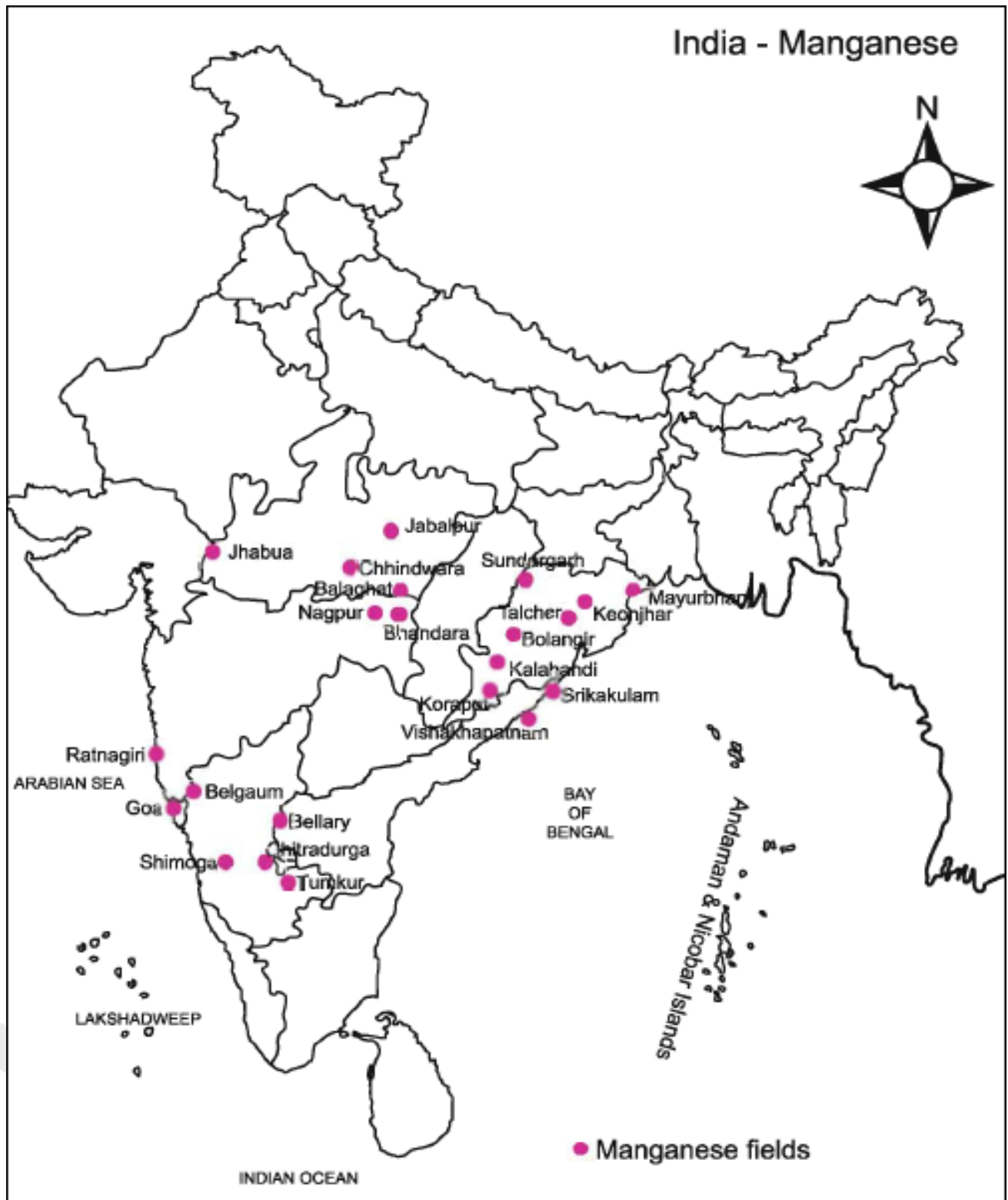
Manganese plays a very important role in the iron and steel industry as it is necessary to make steel hard and rust proof. Manganese dioxide is used for the manufacture of **dry batteries**. It is also used in manufacturing bleaching powder and paints. Manganese producing areas are Balaghat in Madhya Pradesh, Keonjhar, Bonaigarh in Odisha, Bellary, Chitradurga, Shimoga in Karnataka, Tamil Nadu, Maharashtra, Gujarat and Bihar.

Indian – Iron Ore

winmeen.com



Indian – Manganese



Bauxite

It is the ore of aluminum. Aluminum is a light metal formed by the decomposition of rocks rich in aluminum silicates. Due to good conducting, great malleability and extreme lightness it has got enormous industrial importance.

The major bauxite producing centers of India are Bilaspur in Chattisgarh, Ranchi in Jharkhand, Ratnagiri, Raigarh in Maharashtra, Sambalpur, Kalahandi in Odisha, Goa, Gujarat, Karnataka and Tamil Nadu (Salem, Madurai, Nilgiri).

Copper

Copper is another metal found in nature as a good conductor of heat and electricity. It has an important role in the Electrical goods industry. Copper is mixed with other metals to form alloys.

Copper producing areas are Singhbhum in Jharkhand, Guntur and Nellore in Andhra Pradesh, Balaghat in Madhya Pradesh, Rajasthan and Karnataka.

Mica

Mica is a bad conductor of electricity and so it is used in the manufacture of **electrical goods**. India contributes about 60% of the mica production in the world. Major mica producing states of India are Andhra Pradesh, Jharkhand, Bihar and Rajasthan.

Conservation of Mineral Resources

The total volume of usable mineral deposits is one percent of the earth's crust. Mineral consumption is very rapid and extensive. But the geological process of minerals formation is unable to replenish these resources over a short period of time. Therefore they are non-renewable resources.

A concerted effort has to be made in order to use our mineral resources in a planned and sustainable manner. New technologies need to be evolved to use low grade ores at low costs, recycled metals, using scrap metals and other substitutes to conserve our mineral resources for the future.

Energy Resources

Energy is an inevitable resource in our day-to-day life. It is an essential component in economical and technological development. Coal, Petroleum, natural gas solar energy and wind energy are some of the sources of a energy. Energy Resources can be classified into Non-Renewable and Renewable energy resources.

Non-Renewable Energy Resources

Coal

Coal is the major energy resource in India. 67% of the energy requirement of the country is met from coal. It is mainly used in Iron and steel industries. Coal is also known as '**Black Gold**'. Coal is classified into many varieties based on its quality and the amount of **carbon content** in it. They are 1. Anthracite 2. Bituminous 3. Lignite 4. Charcoal.

Many coalfields are located in the northeastern India. About two thirds of the total production of coal is made from Jharkhand, Madhya Pradesh, Chhattisgarh and Odisha. One third of the total production is obtained from Andhra Pradesh, Maharashtra, West Bengal and Uttar Pradesh. Lignite is extracted in Neyveli, Tamil Nadu.

Petroleum

Peyroleum, known as '**Mineral Oil**', is mined from the layers of **sedimentary rocks**. India has a reserve of 4000 million tons, but only 25% of it is possible to be excavated. About 33 million tons of petroleum is mined in India annually. 63% of this is from **Mumbai High**, 18% from Gujarat and 16% from Assam. The remaining 3 % is rigged from Arunachal Pradesh, Andhra Pradesh and Tamil Nadu.

Natural Gas

Deposits of natural gas are seen in the earth crust either independently or along with Petroleum. About 23 billion cubic meters of natural gas is used in India. India's natural gas reserve is only 700 billion cubic meters. Most of the deposits of natural gas is found in Andhra

Pradesh, Maharastra, Gujarat, Assam and Andaman-Nicobar islands. Andaman alone has about 47.6 million cubic meters of natural gas reserve. Recently it has been found out that **Krishna – Godavari** delta has reserves of Natural gas.

Electricity

Power and electricity play a vital role in the growth and development of a country. Electricity is mainly produced in three ways. They are 1. Thermal electricity 2. Hydro electricity 3. Nuclear electricity

1. Thermal Electricity

Thermal Electricity or thermal energy is produced using coal, petroleum, natural gas etc. The state of Assam, Jharkhand, Uttar Pradesh, West Bengal and Tamil Nadu depend mainly on thermal electricity. It is also produced in Punjab, Haryana, Rajasthan, Karnataka, Kerala, Odisha and Delhi. 66% of the total production of electricity in India is from thermal power station.

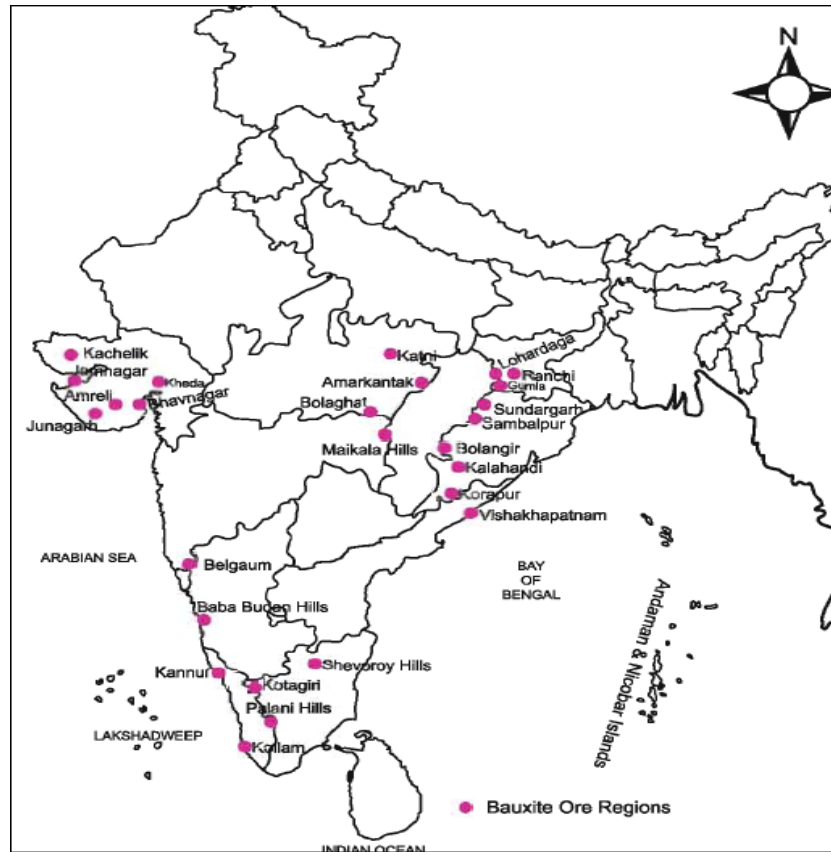
2. Hydro Electricity

In India the first hydro electricity power station was started 1897 in Darjeeling. In 1902 another power station was established at **Sivasamudram waterfalls**, in river Cauvery. At present twenty one percent of the electricity produced in India is from hydropower. It highly influences the economic development of India. Hydro electricity is mainly produced in Himachal Pradesh, aKarnataka, Kerala, Jammu & Kashmir, Meghalaya, Tipura and Sikkim. Kerala depends mainly on hydro electricity projects for the generation of electricity.

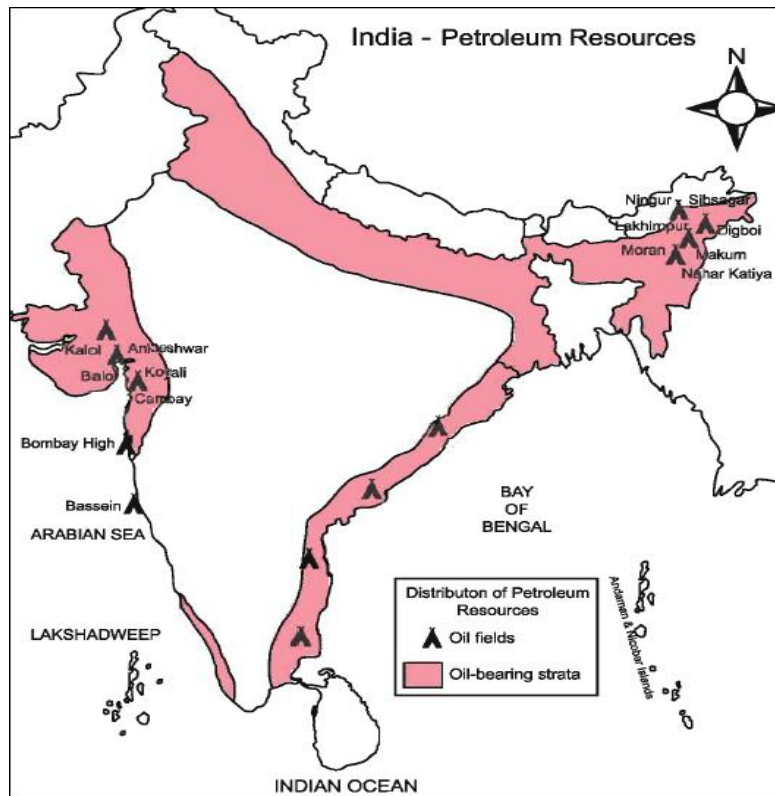
3. Nuclear Electricity

Nuclear Electricity is produced from minerals such as **uranium** and **thorium**.

India – Bauxite Ore Regions



India- Petroleum Resources



India- Coal Resources



They are mined mainly from the state of Jharkhand and the Aravalli ranges of Rajasthan. Uranium is separated from the monazite, coastal sands of Kerala. 50% of the world's thorium deposit is found in India, Tharapur(Maharashtra), Kalpakkam, Koodankulam(Tamil Nadu), Rawath Bjatta (Kota Rajasthyan), Narora (Uttar Pradesh), Kakrapara(Gujarat) and Kaiga(Karnataka) are the nuclear power stations in India. India produces 3% of the total electricity from Nuclear energy.

Renewable Energy Resources

As the demand for energy increase, the importance of renewable resources such as the sun, wind, tide, bio-gas, etc., also increases. Renewable resources contribute 10% of total electricity produced in India. The importance of these energy resources are:

1. Easily available
2. Renewable
3. Environment friendly
4. Pollution free
5. Low production cost
6. Continuous availability

Solar Energy

India, located in the tropical region, has immense potential of solar energy. Sunlight can be directly converted to electricity through the '**photo voltaic technology**'. It is possible to generate 20 megawatt of electricity through this method from 1 sq.km.area. Solar energy is most commonly used in Cooking and Lighting. The largest solar energy conversion centre in India is located at '**Madhapuri**', near Bhuj in Gujarat.

Wind Energy

Wind energy producing centers are established in many parts of the country. The initial expenses for erecting the windmills are huge. The wind energy can be generated if the wind

velocity exceeds 30 knot. Tamil Nadu, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have wind energy producing centres.

Biogas

Bushes, wastes from crops, human and animal wastes are used to produce biogas. These materials are allowed to decay in order to produce the gas. This gas is used for domestic purposes in rural areas. Biogas can give higher temperature compared with kerosene and charcoal.

Tidal Energy

India is estimated to possess 8000 to 9000 megawatt of tidal Energy potential. The **Gulf of Khambhat** is the best suited with 7000 MW potential. This is followed by Katch(1000 MW) and Sundarban (100MW).

Wave Energy

Wave energy potential in India is estimated of about 40,000MW. A wave energy power plant of 150MW has been installed at **Vizhinjam** near Thiruvanthapuram, another 1MW wave energy plant is being setup in the Andaman and Nicobar Islands.

Conservation of Energy Resource

Energy is a basic requirement for economic development. Every sector of the national economy such as agriculture, industry, transport, commerce and domestic needs energy inputs. The developmental plans are being implemented since Independence in all sectors. As a result, consumption of energy in all forms has been steadily rising all over the country.

In this background, 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 conservation.

India is presently one of the least energy efficient countries in the world. We have to adopt a cautious approach for the judicious use of our limited energy resources.

We can conserve energy by:

- a) Using public transport systems instead of individual vehicles
- b) Switching off electricity when it is not in use,
- c) Using power saving devices
- d) Using non-conventional sources of energy. Because “energy saved is energy produced”.

Need for conservation of Natural

We know that nature provides us all resources to satisfy our basic needs but we tend to overexploit it. If we go on exploiting the nature, there will be no more resources available in future. There is an **urgent need to conserve the nature**. Some of the needs are

- 1. To maintain ecological balance for supporting life.
- 2. To preserve different kind of species (biodiversity).
- 3. To make the resources available for present and future generation.
- 4. To ensure the survival of human race.

Geography Notes Part 26**India- Agriculture**

Agriculture plays a vital role in socio-economic development of India. It is a source of livelihood and food security for Indians. It constitutes large share of country's national income because more than half of India's workforce is employed in agriculture. The growth of industries and trade also depend on the growth of agriculture.

In India different agricultural patterns are practiced due to varied geographical factors. Now, we will deal about how geographical factors determine the agricultural activities and patterns of agriculture and how agriculture contributes to national economy.

Major determinant factors of agriculture:

- 1) Land form

2) Climate

3) Soil types water

1. Landform

India is a land of diverse landscape comprising of mountains, plateaus and plains. Among them the plains are more suitable for agriculture due to **rich alluvial soil** which enhance the agricultural productivity. For example plains of Ganga and Cauvery.

2. Climate

Most part of India lies within the tropics and enjoys **tropical monsoon climate**. The abundant solar energy, favours the growth of crops throughout the year. The seasonal rainfall added with the irrigational facilities also contributes for the cultivation of crops in all seasons. The amount of rainfall determines the cropping pattern. For example wheat requires moderate temperature whereas rice requires high temperature for its growth. That is why wheat is cultivated in Punjab and rice is cultivated in Tamil Nadu.

3. Soil types

In spite of the growth in technology soil still continues to be one of the most important geographical factors in determining the cropping pattern. Thus rich alluvial soil favours the growth of rice and sugarcane while black soil favours the growth of cotton.

4. Water

Another most important factor in determining agriculture is the availability of water. India is a monsoon country with uneven distribution of rainfall. Irrigation facilities cannot be given to all parts of the nation. So crops that require abundant water are grown in areas of high rainfall or in regions covered under irrigation. To meet the food requirement of the growing population in the areas of low rainfall **dry crops** are grown.

Types of agriculture

Four different types of farming are generally practiced in our country and they are:

1. Primitive agriculture
2. Subsistence agriculture
3. Commercial agriculture
4. Plantation agriculture

1. Primitive agriculture

Primitive agriculture is practiced in the forest areas where heavy rainfall

occurs. A portion of forest is cleared for cultivation and crops are raised for two or three years. Then they abandon the land and shift to another part. This is still practiced on a small scale in the North Eastern States, Madhya Pradesh, Orissa, Andhra Pradesh and Kerala.

Primitive agriculture is known by different names at different places such as “Jhum” in Assam, “Podu” in Orissa and Andhra Pradesh, “Mashan” in Madhya Pradesh and “Ponam” in Kerala.

2. Subsistence Agriculture

The predominant type of Indian agriculture is subsistence farming. In this type nearly half of the production is used for family consumption and the rest is sold in the nearby markets. The farmers concentrate on staple food crops like rice and wheat.

Example: North Ganga plain and in the south Cauvery, Krishna, Godavari and Mahanadi plains.

Large scale improvement has been made in Indian agriculture after independence. The farmer tries to get the maximum possible output from the available land with high input of fertilizers, manures, hybrid variety of seeds, farm machineries and irrigation facilities wherever possible. This type of agriculture is also known as **“intensive agriculture”** and it is generally practiced in alluvial plains.

Rice, the staple food of South India, occupies 44 million hectares. It is the largest rice grown area in the world. India achieved self sufficiency in rice 1977 and regularly exports a small quantity of high-quality basmati rice.

3. Commercial agriculture

Crops in great demand are grown in Commercial agriculture. In this type crops are raised on a **large scale** with the view of exporting them to other countries and for earning foreign exchange. This type of agriculture is otherwise called as “**Extensive agriculture**”. It is practiced in Gujarat, Punjab, Haryana, Maharashtra and Tamil Nadu. Commercial agricultural products are used as raw materials in the agro based industries. Example cereals, cotton, sugarcane, jute etc.

4. Plantation agriculture

In this type of agriculture, single crop is raised on a large area. The plantation has an interface of agriculture and industry. The plantations are mostly owned by the companies. Tea, Coffee and Rubber are plantation crops. These crops are grown on the hilly areas of North Eastern States of India, West Bengal.

The Nilgiris, Anaimalai and Cardamom hills of South India.

Cropping Pattern

While cropping, according to the terrain and climate, the farmers are using various patterns namely, single, double, multiple, mixed cropping and crop rotation.

Single cropping also known as mono cropping is a system of farming where one crop can grow during a season or a year.

Double cropping is a system under which two crops are raised by the farmers from the same plot of land during a year.

Multiple cropping is a system under which the farmer grows more than two

crops from the same plot of land during a year.

Mixed cropping means the cultivation of more than one crop simultaneously on the same piece of land. The two crops are sown together but harvested at different times.

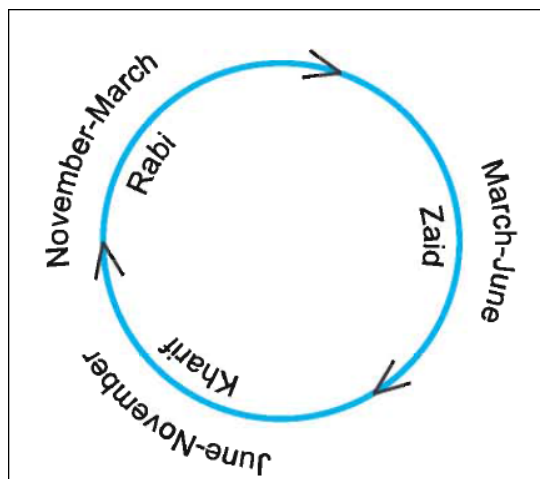
Crop rotation is a system of farming by which different crops are alternately grown on the same land in a specific order.

Agricultural Seasons of India

The agricultural activities begin with the onset of monsoon in the month of June. India has three major cropping seasons in a year, as shown in the following table

Agricultural seasons

Name	Sowing Period	Harvest period	Major Crops
Kharif	June (Beginning of monsoon)	Early days of November	Paddy, maize, cotton, millet, jute, sugarcane
Rabi	November (Beginning of winter)	March (Beginning of summer)	Wheat, Tobacco, Mustard, Pulses, Linseed, Grains
Zaid	March (Beginning of Summer)	June (Beginning of monsoon)	Fruits, Vegetables, Water melons, Cucumber



Agricultural seasons

Production of food crops

Diversity of food crops is ascertained according to the factors of temperature, rainfall and soil type. The major food crops of India are:

Paddy

Paddy is the most important food crop of India. India stands in second place in the production of paddy. India and China together produce about 90% of the total world production of Paddy. In areas of less rainfall particularly in Punjab and Haryana it is grown with the help of irrigation. Cheap labour is required for sowing, weeding, harvesting and other processes. Suganah 5, Sukaradhara-1 are the hybrid variety seeds recommended for the cultivation in the areas of Haryana, Delhi, Jammu and Kashmir and uphills of Himachal Pradesh and Uttarakhand.

The other rice producing states are west Bengal, Punjab, Uttarparadesh, Bihar and Odisha in North India and Tamil Nadu and Andhra Pradesh in South India. Most of the production is consumed locally due to dense population. Rice is cultivated two to three times in a year intensively in the deltas of Mahanadhi, Godavari, Krishna and Cauvery.

The Indian Council of Agricultural Research (ICAR), was established in 1929. India's transformation from a food deficit to a food surplus country is largely due to

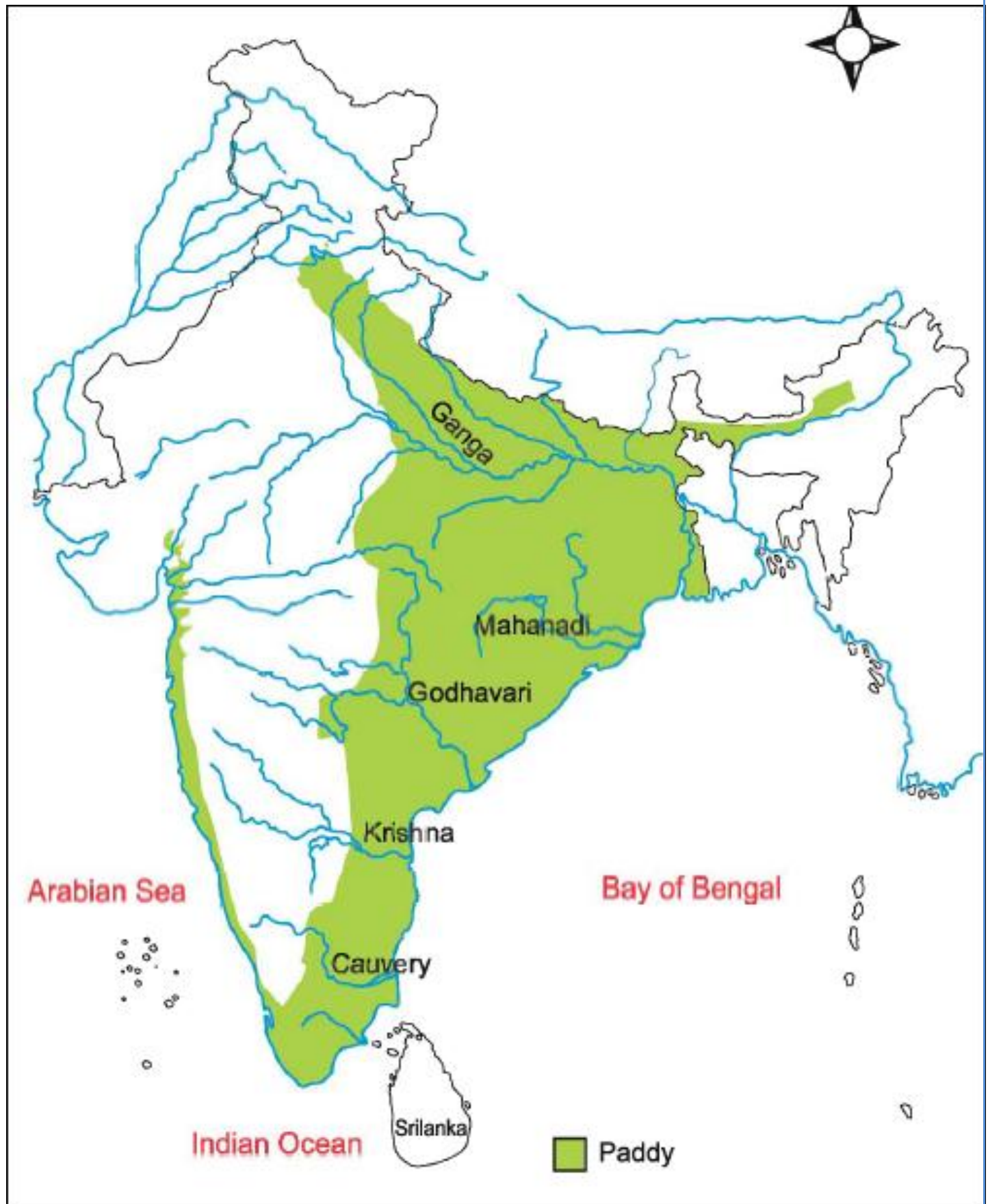
ICAR's smooth and rapid transfer of farm technology from the laboratory to the land.

Paddy cultivation in Tamil Nadu

There is something special about paddy cultivation in Thanjavur District, the '**rice bowl**' of **Tamil Nadu**. The paddy crops grown in this region are classified as Samba, Kuruvai and 'Thaladi' on the basis of the duration of paddy growth. **Samba** is a long term crop. It is grown for about five to six months. **Kuruvai** is a crop grown within three or four months. The paddy grown in the field ploughed with the stumps of the previous harvest is known colloquially as the **Thaladi**.

Although this way of cultivation of paddy is still in practice, it is now been changed with the impact of modern cropping. This has also led to great change even in harvest seasons.

India- Paddy growing areas



Wheat

Wheat is an important food Crop. It is the **staple food** for the northern and northwestern part of India. Wheat is cultivated both in winter and spring.

Uttar Pradesh and Haryana are the major producers. Rajasthan, Madhyapradesh, Chattisgarh, Maharashtra, Gujarat, and Andhrapradesh are the other wheat producing states. The production of wheat has been increased in Punjab and Haryana due to the impact of Green Revolution. Our country is now in a position to export wheat to other countries.

Besides, paddy and wheat, **dry crops** also play vital role in the food grain production. They grow well even in the infertile soil. They are drought resistant crops.

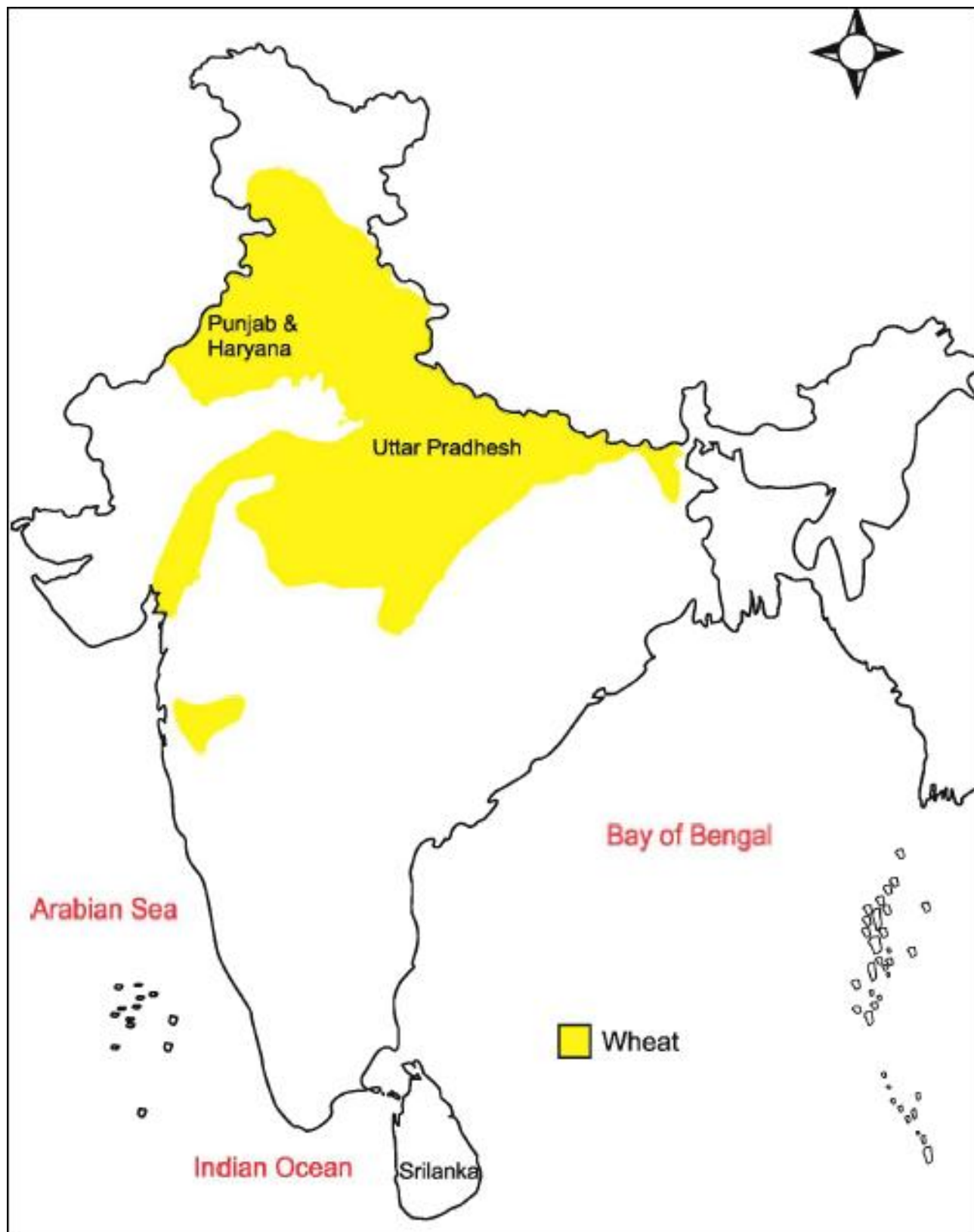
Rainbow of Revolutions

Title	Associated with the production of
Green Revolution	Agricultural Crops
White Revolution	Milk and Milk Products
Silver Revolution	Eggs and Poultry
Golden Revolution	Horticulture
Yellow Revolution	Oil Seeds
Blue Revolution	Marine Products

Millets

Millets as cereal crops are intermediate between rice and wheat. It includes jowar, bajra and ragi. Millets are coarse grain, and dry crops. They are cultivated in poor soils. They are rich in nutritional content higher than wheat or rice. They also provide fodder for cattle. Millets are grown in almost all the states in India, but the important producers are Madhya Pradesh, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, Karnataka, Odisha, Bihar, Maharashtra and Gujarat.

India – Wheat growing areas



Pulses

Pulses crops include a large number of crops which are mostly leguminous and rich in proteins. Pulses serve as an excellent fodder though grams are the most important pulses. Other pulses are black gram, green gram, lentil, horse gram, peas etc.

Pulses are grown in a wide range of climatic conditions mostly in drier areas with or without irrigation facilities. Pulses require a mild cool weather and a low to moderate rainfall.

The most important producers are Madhya Pradesh, Rajasthan, Haryana, Punjab, Maharashtra, Gujarat, Andhrapradesh and Tamil Nadu.

Cash Crops

Many other crops are also cultivated in our country in addition to the above food crops. **Sugarcane, Cotton, Jute, Tea, Coffee, Oil Seeds, Tobacco and Rubber** are some among the, they are mainly produced as raw materials for industries. Besides, they form export material that can earn foreign exchange. So they are known as **cash crops**. They have great influence on the Indian economy also.

Sugarcane

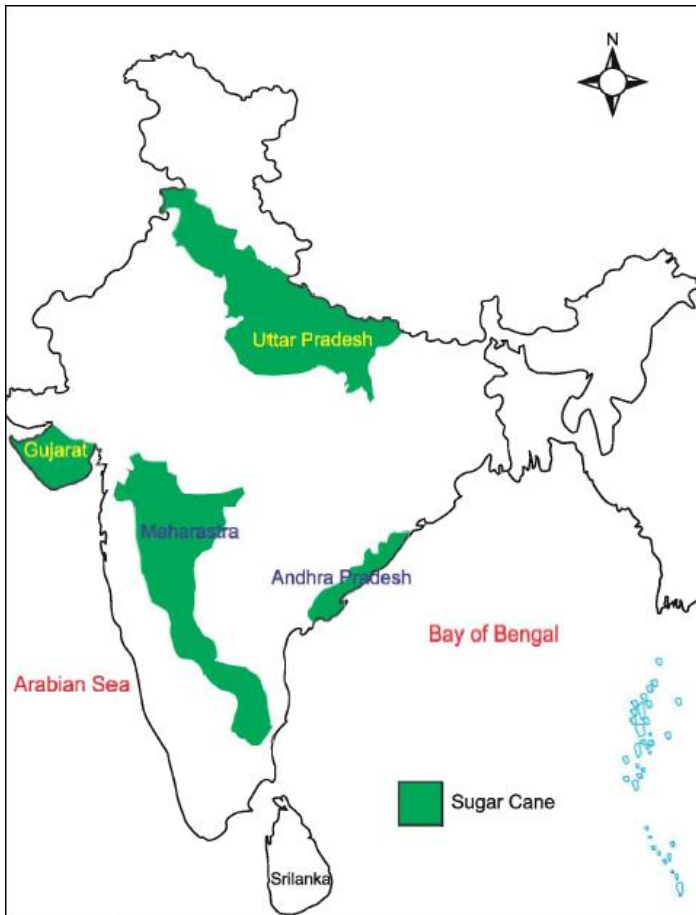
Sugar Cane is a tropical crop. It grows well in the **hot humid climate**. India is the birth place of sugarcane.

It ranks second in production next to Brazil. The Major sugarcane producing states are Uttarpradesh, Tamil Nadu, Andhrapradesh, Karnataka, Gujarat and Maharashtra, Bihar, Punjab and Haryana.

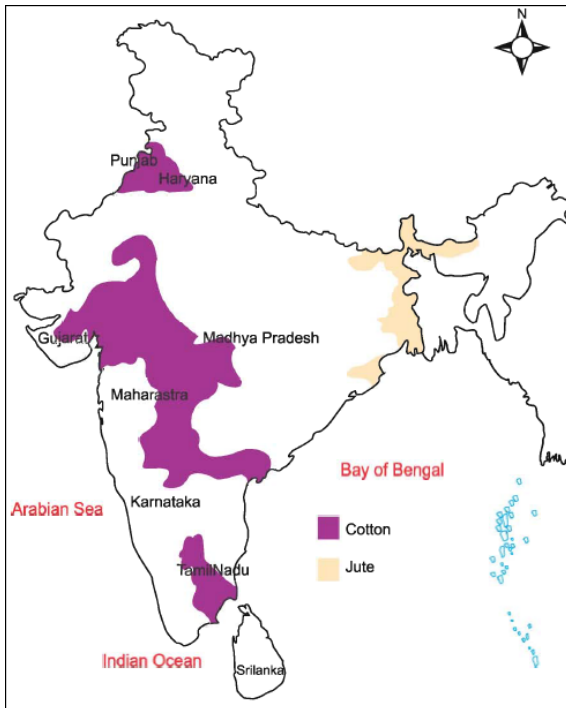
Cotton

Cotton is a major **fibre crop** of India. It provides raw material for cotton textile industry. Cotton grows well in tropical and subtropical climate. Black soil is the most suitable soil for cotton cultivation. India has fourth position in the world cotton

India – Sugar Cane Growing Areas



India- Cotton and Jute Growing Areas



production. The main cotton growing states are Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Madhya Pradesh, Punjab and Haryana.

Jute

Jute is also the most important fibre crop next to cotton. It is also called as **Golden fibre crop**. The fibre is the cheapest and has a commercial demand because of its softness, strength, length and uniformity. It is demanded for the manufacture of gunny bags, hessian, carpets, ropes, strings, rugs and cloth, tarpaulins, upholstery etc.

Its cultivation is restricted mainly to the Ganga Brahmaputra delta in West Bengal, Bihar, Odisha, Assam and Meghalaya. Because this crop requires hot and damp climate. The soil should be well drained fertile soil in the flood plains where soils are renewed every year.

Tobacco

Tobacco is said to have been brought to India by the Portuguese in 1508. Since then cultivation gradually spread to different parts of the country. India is the third largest producer

followed by China and USA. The major tobacco producing states are Tamil Nadu, Andhra Pradesh and Karnataka.

Oil Seeds

India is one of the oil seed producing countries of the world. India grows all types of oil seeds except olive and palmoil. Oil seeds are grown mainly in the tropical and subtropical regions. Indian oil seeds are, groundnut, sesamum, rape seed, mustard, linseed, sunflower seed, castor seed, coconut, soyabean etc. Oil is an important item of Indian food. The oil seeds are used as raw materials for manufacturing a large number of products and form cattle feed and manure. The major oil seeds producing states are Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh, Madhyapradesh, Odisha and Karnataka.

Plantation Crops

Tea

It is an important beverage crop. The tea plant grows well in tropical and subtropical climates endowed with deep and fertile soil. Well drained hill slopes between 3000-4000 feet height are suitable for cultivation. Assam, West Bengal, Kerala and Tamil Nadu are the major producers.

Coffee is the most important beverage crop. Indian coffee is known for its quality. Karnataka produces 60% of Indian coffee. Other coffee growing states are Kerala and Tamil Nadu.

Rubber

Rubber is obtained from latex of rubber tree. Though India occupies sixth position in the world in once of cultivation in production of natural rubber it stands fifth in the world. Rubber plantations cover large areas in southern part of India. About 95% of the areas is confined to the lower elevations of western ghats in Kerala State and 5% spread over Tamil Nadu, Karnataka and Andaman Nicobar islands.

Fruits and vegetables

Fruits and vegetables are an important supplement to the human diet, as they provide essential minerals, vitamins and fibres required for maintaining health. India has the second position in the production of fruits and vegetables. Apple is mostly produced in Himachal Pradesh, Kashmir and Uttarakhand. Production of banana, is concentrated. Orange is cultivated in Maharashtra, Uttarakhand, Himachal Pradesh, Jammu-Kashmir, Tamil Nadu and Karnataka. Grape is cultivated mainly in Uttarakhand, Himachal Pradesh, Jammu and Kashmir, Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka. India contributes about 13% of the worlds production of vegetables.

Animal husbandry and fisheries

Animal husbandry plays an important role in overall economy and in supplementing family income. It generates employment in the rural sector particularly among the landless, small and marginal farmers and women. Production of suitable cross breeds and their wider adoptions has contributed to increase in country's milk production. Poultry and eggs are increasing through genetic improvement and better management practices. The contribution of these subsector is estimated to be about 25 percent of the total value of output agricultural sector.

Though the overall contribution of fisheries is small, **multilayer fish culture** has resulted in a very high annual growth during the past decade.

Development in Bio-Technology

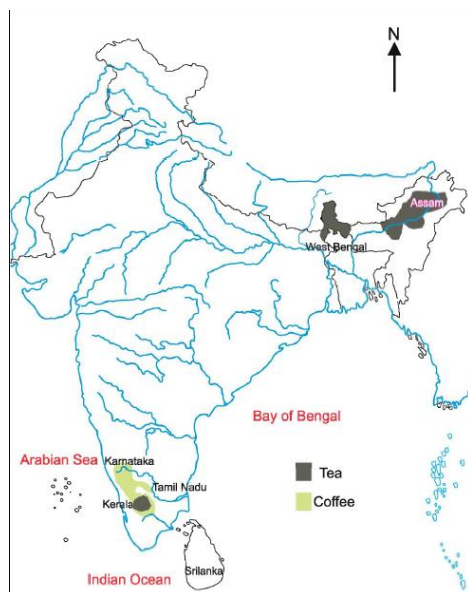
The National Research Centre on plant Biotechnology was established in 1985 to undertake research, teaching and training personal in the modern areas of **“Molecular biology and Biotechnology”**.

The benefits adopting biotechnology in agriculture are,

- Adopting Biotechnology is environmentally safe and sustainable.
- Cost of production of the farmers will be decreased.
- Water requirement for the crop is minimized
- It makes crops more resistant to insects, pests and diseases.

- The yield of the crops per hectare can be increased.
- Farmers can get more income.

India – Tea and Coffee growing areas



Challenges for Indian Agriculture

1. Indian agriculture is a gamble of monsoon. Monsoons are irregular unevenly distributed and uncertain. It exerts a very unfavourable influence on agriculture.
2. The serious drainage problem caused by the increased construction of roads, railways and canals distributed the natural drainage system by checking normal flow of rain water and bringing heavy floods. This results in large scale damage of kharif crop and considerable late sowing of rabi crop.
3. Rabid increase in the construction work of industries and residential buildings reduce the extent of cultivable lands.
4. Global climatic changes affect agriculture through their direct and indirect effects on the crops, soil livestock and pests.
5. The previous strategies for more productivity cause serious problems of environmental and natural resource degradation. In future technologies must result not only in increased

productivity level but also ensure the quality of natural resources. So it will lead to sustainable improvements in agricultural production.

Currently, India is self sufficient with respect to food production.

In future India's population might increase to million approximately by the year . at that time with efficient management of natural resources will meet increasing demand by adopting modern technology in farming, by increasing farmer's access to markets, improving agricultural productivity and public education.

Geography Notes Part 30

India – Industries

India is rich in natural resources. These resources include forest products, agricultural products and Minerals. Some of the resources can be used directly but some of them need **processing**. For example cotton has to be processed before it is brought into use in the form of finished product. So cotton is the raw material of agricultural origin. Similarly products like petrol, diesel, kerosene and gasoline are derived at different degrees of refinement of petroleum. Thus Petroleum is of mineral origin.

Though agriculture is the major occupation of the people in India, there has been a tremendous growth in industries under five year plans and it has provided job opportunities for many people. This in turn has improved their **standard of living**.

Factors Influencing Location of Industries

The location of an industry is determined by raw material, power, transport, man power, water, market and government policies.

Raw material

Industries are located with respect to the availability of raw materials. For example, Sugar industry is located near the raw material region(sugarcane field) because sugarcane is a weight

losing material and when it is processed, the weight of sugar becomes 10 percent of the weight of sugarcane.

Power

Most of the industries tend to be located near the source of power. The power is needed to process raw materials. For example Iron and steel industries are generally located near the coal fields because it requires about 5 tons of coking coal to melt 1 ton of iron ore.

Transport

Transport is an important factor for carrying raw materials to manufacturing units and finished products to the market. For example Iron and steel industries near railway stations or near the port as these industries involve a high cost of transportation.

Man Power

Availability of skilled and unskilled or technically qualified manpower is an important factor for the location of industries. Urban areas tend to have a better supply of skilled and semi-skilled labour due to rural-urban migration. For example Mumbai and Chennai get manpower from all over the country.

Water

Water is very essential for industries like iron and steel, textiles, rayon, paper etc. For example 1 ton of cooling and 1 ton of rayon needs 100 tons of water for bleaching. Hence the above industries are located near the rivers, canals or lakes.

Market

High demand and purchasing power determine the market. So most of the industries are located close to the centers of consumption because it reduces the cost of transportation and enables the consumers to get things at comparatively cheaper rates.

Government Policy

In almost every country, the government policies play an important role in determining the location of industries. In order to avoid regional disparities, the State government has marked out certain areas as **industrial zones**. These industrial zones and government concessions have helped in the growth of industries in the backward areas.

The advances of science and technology have redefined the factors for industrial prosperity. Low-cost manpower and energy alone are insufficient for industries to thrive in a highly competitive and globalised market place; Highly skilled labour capital abundance and export potential are all factors that play a critical role in increasing productivity and efficiency of industrial production.

Classification of Industries

On the basis of the source of raw materials, industries are classified into **Agro based** industries, **Forests based** industries and **Mineral based** industries.

Agro based industries

These industries use agricultural products as their basic raw material. For example, Cotton textile industry, jute industry, sugar industry etc.

Cotton Textile Industry

Cotton textile industry is based on indigenous raw materials, cotton. It contributes about 14% industrial production, provides employment to 35 million persons and 4% towards GDP.

Mumbai in Maharashtra is the leading cotton textile centre and it is called as the “**Manchester of India**”. The following factors favour the cotton textile industries in Mumbai;

- Location of **port facilities** for the export of finished goods.
- Well connected through **rail** and **road links** with cotton growing areas.
- Humid **coastal climate** favours yarning.
- Availability of **Capital goods** and finance.
- Availability of **man power**.

The Major Cotton textile producing states of India are Maharashtra, Gujarat, West Bengal, Uttar Pradesh, and Tamil Nadu.

In Tamil Nadu, Coimbatore, Erode, Tiruppur, Karur, Chennai, Tirunelveli, Madurai, Tuticorin, Salem and Virudhunagar are the major cotton textile centres.

India's cotton textile industry holds third place among cloth producing countries in the world. India ranks second in the world in Cotton textile Trade and stands first amongst the industries in our country.

Jute Industry

The Jute sector has been playing an important role in the economy of the country. It provides sizeable employment in the agricultural and industrial sectors. About 4 million farmers are engaged in the cultivation of jute. India tops in the production of raw jute and jute in the production of raw jute and jute goods and second in the export of jute goods next to Bangladesh.

Jute products include gunny bags, canvas, pack sheets, jute webs, Hessians, carpets, cordage and twines. Now jute is also being used in plastic furniture insulation, bleached fibers to blend with wool. It is also mixed with cotton to make carpets and blankets.

Nearly 90% jute industries are located in **West Bengal** mainly along the **Hooghly River**. Recently there has been dispersal of jute industries in Uttar Pradesh, Bihar, Odisha and Andhra Pradesh.

Sugar Industry

- ❖ Indian Sugar Industry is the second largest agro based industry in India. Sugar factories are located near the areas of cultivation due to the following factors:
- ❖ Sugarcane is a weight losing material
- ❖ It cannot be stored for long time, as it loses sucrose content.
- ❖ It cannot be transported for long distances.

Since sugarcane harvesting is done in a particular season and crushing

needs to happen within a limited period, sugar factories do not function throughout the year.

Uttar Pradesh and Bihar alone account for 70% of the sugar production. So this belt is known as '**sugar bowl of India**'. Punjab, Haryana, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu are the other sugar producing states of India.

Nellikupam, Pugalur, Coimbatore and Pandyrapuram are the famous centres for sugar production in Tamil Nadu.

The Government of India has developed a dual price system for internal sugar trade. Every sugar mill has to sell 40% of its production to the government sells this sugar through public Distribution System. Rest of the 60% is sold in the open market at a higher price.

India is the fourth major sugar producing country in the world. Top three countries are Cuba, Brazil and Russia. India exports some of its surplus sugar to USA, UK, Indonesia, Malaysia, Iran and Sri Lanka.

Forest Based Industries

India has a rich diversity of forest resources which are capable of supporting a wide variety of industries. The most important is the paper industry.

Paper Industry

Paper industry is a vital and core industry for any country. The Raw materials for paper industry include woodpulp, bamboo, salai and sabai grasses, waste paper and bagasse. Location of the industry is greatly influenced by **bulky raw materials** and to a lesser extent by **market**.

The Indian paper industry is ranked one among the fifteen top global paper industries in the world. The leading states in paper production in our country are West Bengal, Maharashtra, Madhya Pradesh, Karnataka and Andhra Pradesh.

Mineral Based Industries

Mineral based industries use both metallic and non-metallic minerals as raw materials. The Major mineral based industry of our country is the **iron and steel industry**.

Location of Iron and Steel Industries in India

India's major iron and steel industries are located either near the **coal fields** or **iron ore** mines or midway between the coal and iron ore fields. Most of our country's major iron and steel industries are located in the **Chota Nagpur Plateau** region due to the following reasons:

- ❖ High grade haematite and magnetite iron ore are available from the mines of Jharkhand, Bihar, Odisha, Madhya Pradesh and Chattisgarh.
- ❖ Jharia and Singbhum in Jharkhand, Raniganj in west Bengal have abundant coking coal suited for the manufacture of high grade steel.
- ❖ West Bengal and Jharkhand states are rich in flux materials needed for purifying.
- ❖ Limestone from Ranchi, Silica from Jabalpur and Dhanbad, Dolomite from Madhya Pradesh, Quartz from Bihar are available in close proximity.

Distribution of Iron and Steel Industries

India has 11 integrated steel plants and 150 mini steel plants and a large number of rolling and re rolling mills.

1. Tata Iron and Steel Company (TISCO)

In 1907 Tata Iron and Steel Company was setup at **Jamshedpur** now it is called **Tata Steel limited**. It is the oldest and the largest integrated iron and steel plant in India. It is the 10th largest producer of Iron and Steel in the World. The company produces pig iron and steel.

2. Indian Iron and Steel Company (IISCO)

The steel plants at Kulti, Burnpur and Hirapur were integrated and the Indian Iron and steel company was setup at Burnpur in 1919.

The control and management of IISCO were taken over by SAIL(Steel Authority of India) in 1972. The company produces pig iron and crude steel.

3. Visveshwaraya Iron and Steel Limited (VISL)

Visveshwaraya Iron and Steel Limited were set up in 1923 at Bhadravati in Shimoga district in Karnataka. Its major products are alloy and special steel.

4. a. Hindustan Steel Limited (HSL)-Bhilai

The HSL- Bhilai is located in the Durg district of Chattisgarh, started its production in 1959 Bhilai's **rail** and **structural mill** are one of the most modern and largest in the world. It has also started making plates for ship building industry.

4. b. Hindustan Steel Limited (HSL)- Rourkela

The Rourkela plant was started in 1965 in the Sundargarh district of Odisha. Its major products include hot and cold rolled sheets , galvanized sheets and electrical steel plates.

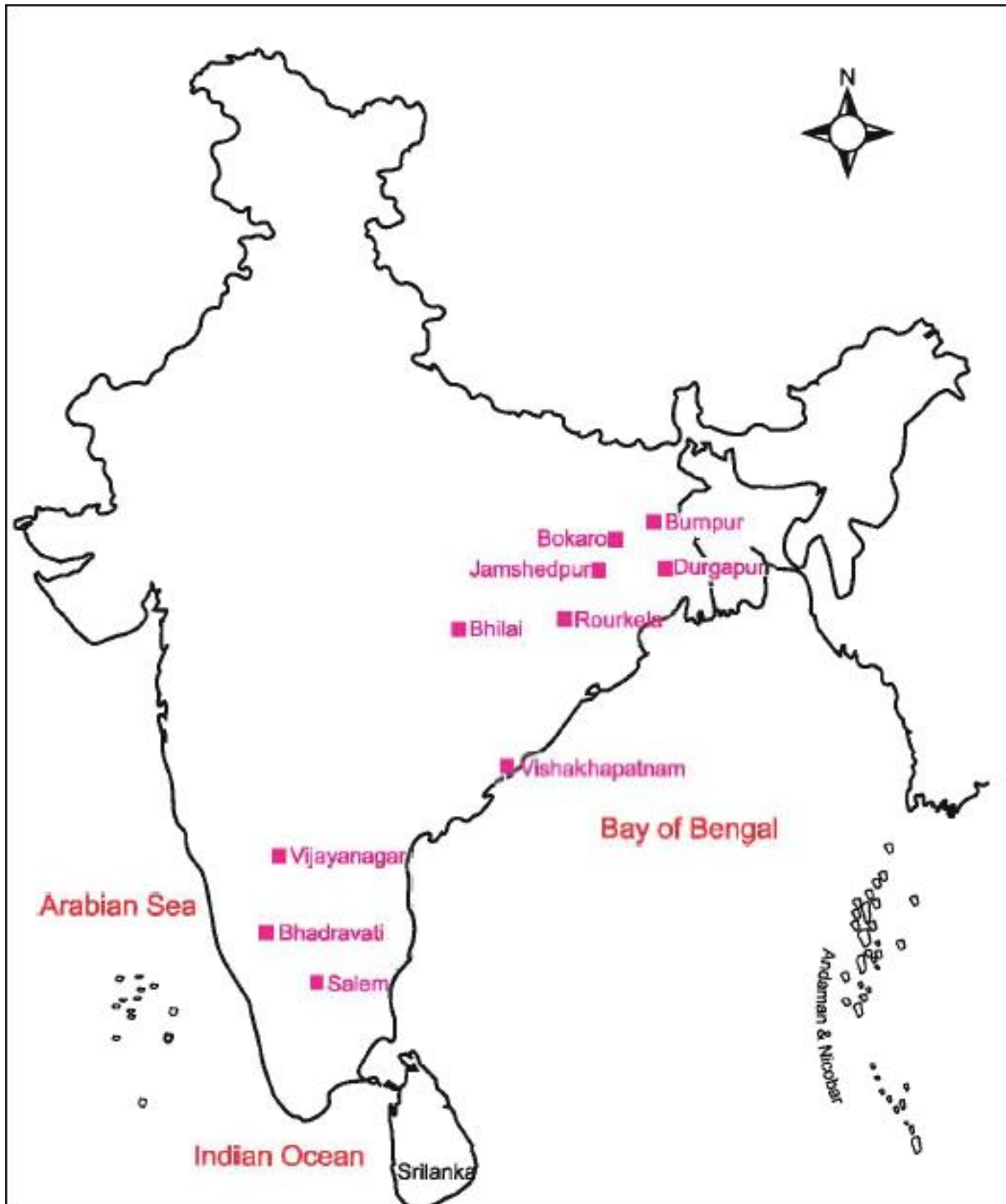
4. c. Hindustan Steel Limited(HSL)- Durgapur

The Durgapur steel plant is located at Bardhaman district of West Bengal. It was setup in 1959. It started its production in 1962. This plant specializes in the manufacture of alloy steel, construction material and railway items wheel axles and sleepers.

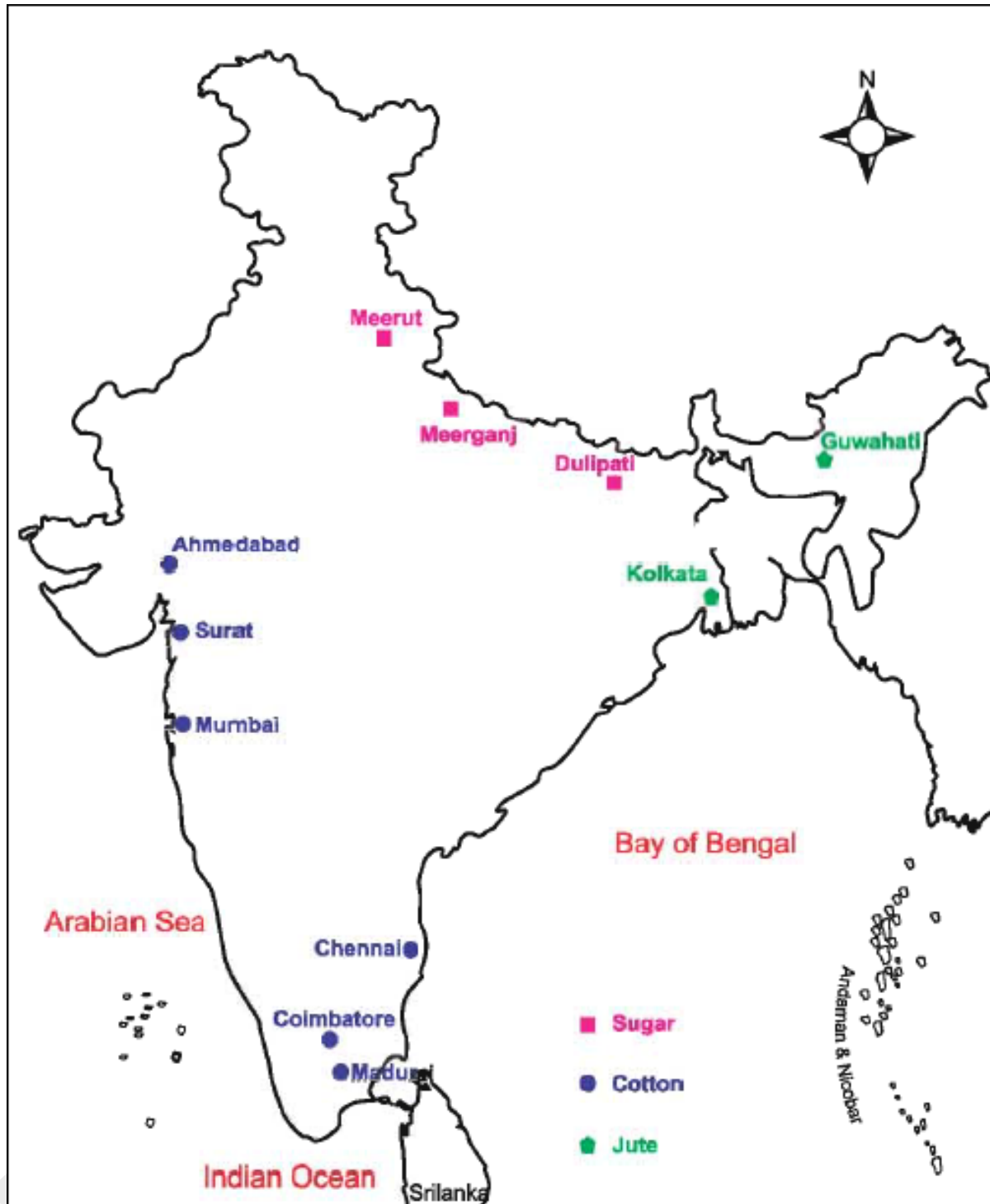
4. d. Hindustan Steel Limited (HSL)- Bokaro

The Bokaro steel plant is situated in the Hazaribagh district of Jharkhand. It started its operation in 1972. The sludge and slog of the plant are used in making fertilizer at Sindri.

India- Iron and steel industries



India- Sugar, Cotton and Jute Industries



5. The Salem Steel plant

The Salem steel plant is located at Salem in Tamil Nadu and started its

production in 1982. This plant is the major producer of the world class stainless steel which is exported to many advanced countries in the world.

6. The Vijayanagar Steel Plant

The Vijayanagar steel plant has been setup at Tornagal in Hospet district in Karnataka.

7. The Vishakhapatnam Steel Plant

The Vishakhapatnam steel plant came into operation in 1992. This is the first plant in the shore region. This is the most sophisticated and modern integrated steel plant in the country. It is a major export oriented steel plant.

Mini Steel Plants

Mini steel plants are decentralized secondary units with capacity ranging from 10000 tonnes to 5 lakh tones per year. It operates through electric furnaces and generally use ferrous scrap, pig iron or sponge iron as raw materials. They help in recycling of iron and make the scrap useful and profitable. They produce mild steel alloy steel and stainless steel.

There are more than 150 Mini Steel plants with an installed capacity of about 120 lakhs tones of crude steel per annum. Most of the mini steel plants, so that they can meet the local demands.

They suit the Indian economy because they require less investment. As these units are smaller in size they can be conveniently located in the industrial towns.

Automobile Industry

The growth of automobile industry in India is only after the independence, the first automobile industry was started at Kurla(Mumbai) in 1947 under the name of **Premier Automobile limited**. In 1948 Hindustan motors limited setup the automobile industry at Uttarpara,(Kolkata). In the last 30 years, India has made a tremendous progress in this industry by manufacturing commercial vehicles, passenger cars, jeeps, scooters, motorcycles, mopeds and three wheelers.

The major centres are Mumbai, Chennai, Kolkata, New Delhi, Pune, Ahmedabad, Lucknow, Satara and Mysore.

With Liberalization of the economy there are several foreign collaborations in the automobile sector and well known world leaders have entered the market-Suzuki, General motors, Ford, Mitsubishi, Honda, Daewoo, Mercedes, Nissan, Mahindra & Mahindra and Millennium Motors.

Electronic Industries

The electronic industry in India started with radio manufacturing in the 1850s. the setting up of **Indian** Telephone Industry in 1950 at Bangalore(Bengaluru) gave a boost to this industry. The industry now meets the needs of posts and telegraph, defence, railways, electricity boards, meteorological department etc. **Bengaluru** is the leading producer of electronic goods and it is referred as **Electronic Capital of India**. The other important centres are Hyderabad, Delhi, Mumbai, Chennai, Kolkata, Kanpur, Pune, Lucknow, Jaipur and Coimbatore.

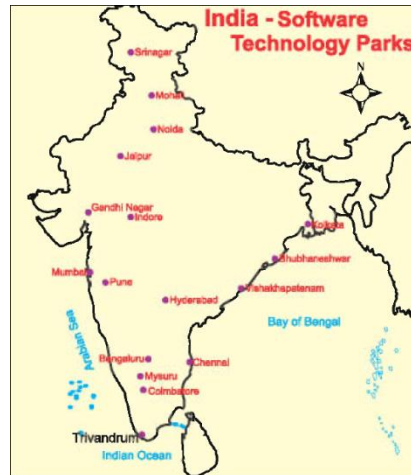
The revolution in the electronic industry has had an impact on the lifestyle of the people. The most popular and widely used electronic products today are television, cellular phones, computers and computer-related products like ipod and Pendrive etc.

Software Industry

The Software Industry has emerged as a major industry in the Indian economy.

The main reason for its rapid growth is due to the availability of cheap and skilled young software professionals in our country.

India- Software Technology Parks



Department of Electronics and Information Technology (Ministry of Communication and IT) has established. 'IT Parks' The main centers are Chennai, Coimbatore, Thiruvananthapuram, Bengaluru, Mysuru, Hyderabad, Vishakapatnam, Mumbai, Pune, Bhubaneswar, Indore, Gandhinagar, Jaipur, Kolkata, Noida, Mohali and Srinagar.

At present there are more than 500 Software firms in the country. In 2014, the software industry generated a total direct employment of around 2.5 million in 2014 and accounts for 7.5% of India's GDP Today the software industry in India exports software and services to nearly 95 countries around the world.

The Government has also played a vital role in the development of software industry.

Industrialization, Urbanization and growing population along with increasing consumption of Resources have by far crossed the carrying capacity of the earth. Industrialization has undoubtedly made life more comfortable for modern man, but it has led to extreme **stresses** and **degradation** on the environment and its resources. Indiscriminate use of substances has a detrimental effect on environment. These have made the world realize the importance of preserving our environment by changing harmful technologies into more eco-friendly technology.

Geography Notes Part 30

Environmental Issues

The word **environment** is most commonly used to describe **Natural Environment** which means the sum of all living and non-living things that surrounded us.

Whose Environment is it?

It is everyone's. Nature has enough to satisfy everyone's need but has not enough to satisfy every man's greed. Our expanding greed has put us in a tough situation of various environmental problems. The problems are due to rapidly growing population from 300 million in 1947 to 1210 million at present and industrialization. They have direct impact on environmental degradation, pollution and climatic changes. The whole world is now anxious to repair the damage. Let us discuss important environmental issues which are threatening environmental sustainability.

Environmental Pollution

Environmental pollution is the contamination of environment which causes discomfort, instability, disorder harmful impact on physical system and on living organism.

Pollution can take the form of chemical substance, or energy, such as noise, heat or light energy. This in turn affects the ecology of the environment. There are many types of pollution degrading the environment. They are given below.

- 1) Air Pollution
- 2) Water Pollution
- 3) Land Pollution
- 4) Noise Pollution
- 5) Pollution due to biochemical wastes.
- 6) Pollution due to e-wastes.

7) Pollution due to mining

1. Air Pollution

It is contamination of air by the discharge of harmful substances. Air

pollution has been a problem throughout the history. This can have serious effect on the health of the human beings. We breathe about 2200 times a day inhaling around 16 kg of air. Every time when we breathe in we inhale dangerous substances. These dangerous substances or pollutants can be either in the form of gases or particles.

The source of pollutants is both natural and man-made.

Volcanic eruptions, wind erosion, pollen disposal, evaporation of organic compounds and natural radio activity are the natural causes of air pollution. Natural air pollution does not occur in abundance and also possesses little threat to the health of the people and ecosystems.

“Gigantic Explosion of Mt. Helens released only about what one coal power plant emits in a year”.

The man-made reasons for air pollution are vehicular emission, thermal power plants, industries and refineries.

Vehicular emissions are responsible for 70% % of the country's air pollution. Vehicles which are eco-friendly are certified **BHARATH II and III.**

Bharat Stage I – IV emission norms are emissions standards that focus on regulating pollutants released by automobiles (motor cars) and other powered vehicles.

Most sulphur dioxide comes from power plants that use coal as their fuel. Automobiles produce about half of the nitrogen oxide.

Listed here are the major air pollutants: sulphur oxide, nitrogen oxide, **carbonmono oxide** and organic compounds that can evaporate and enter the atmosphere. **India emits the fifth most carbon of any country in the world.**

“The Bhopal gas tragedy is one of the world’s worst industrial disasters that killed almost 8000 people in December 1984”.

Air pollution can adversely affect human health not only by direct inhalation but indirectly by other routes through water, food and skin infections. Most common air pollution directly affects the cardio-vascular systems of humans and cause diseases like asthma, bronchitis, allergies, lung and heart diseases.

Effects of Air Pollution

1. Ozone layer depletion

The atmosphere contains a thin layer of ozone about 24 to 40 km above earth’s surface which protects life from the harmful **ultraviolet rays** of the sun. the release of chemicals such as CFC widely used in refrigerators has damaged the ozone layers.

Ozone monitoring stations in Antartica have already detected average losses of 30% to 40% of total ozone over the region. Each one percent loss of ozone is to cause an increase of about 2% in UV Radiation. This will reduce the immunity of the body and cause eye cataracts and skin cancer.

2. Global Warming(green house effect)

Global warming is caused by the increases of green house gases such as carbon-di-oxide, methane, water vapour, CFCs which are responsible for the heat retention ability of the atmosphere. The rapid increase in average temperature of the earth will cause major changes in weather patterns all over the world.

Rise in global temperature, will also result in the melting of polar ice caps and glaciers. This in turn will raise the sea level. Land use changes will occur in coastal areas due to sea level rise. It will cause damage to coastal structures, post facilities and water management systems.

Global temperature rises will also affect the agricultural patterns.

3. Acid Rain

Acid rain was first discovered in 1852. This is one of the most important environmental problems, caused by indivisible gases given out by automobiles or coal burning by power plants.

The gases that cause the acid rain is **sulphur-di-oxide** and **nitrogen oxides**. Fire and bacterial decomposition are the natural causes which increases a nitrogen oxide in the air.

These pollutants combine with water vapour in the presence of sun light and oxygen and form dilute sulphuric and nitric acids. When these mixture precipitates from the atmosphere. It is called as **acid rain**.

Acid rain falls down to the earth in all forms of precipitation. Acidity in the rain can harm and even destroy both natural ecosystems and man-made products.

Acid rains, when falling on oceans, reach the coral reefs. This has killed more than 70% of corals in Lakshadweep and Andaman islands.

The acid rain affects the eco systems by the following ways:

- The most basic microscopic organism such as plankton may not be able to survive. So the sea animals, depending on planktons will die and the food chain will be affected.

If the ocean temperature increases, growth of coral reefs will be affected. The corals control the proportion of carbon dioxide by turning CO₂ in the water to limestone shell. Moreover, coral reefs grows in temperature just above 10⁰ Celsius.

Other ecosystems such as forests and desert will also be harmed.

Loss of bio-diversity and extinction of rare species will occur.

- They also change the acidity level of the soil by leaching crucial nutrients. Thus it affects forest vegetation.

“For the protection of the ozone layer, Montreal Protocol and Vienna meet of

30 nations world wide agreed to reduce the usage of CFC's"

Steps to be taken to control Acid rain

Environmentalists advocate the installation of sulphur cleaning scrubbers in factories, finding new methods of burning coal and shifting to non-polluting renewable forms of energy production.

Smog

The word smog is a combination of the words smoke and fog. Smog causes a smoky dark atmosphere, especially over cities. It decreases visibility, and creates haze throughout the area.

What can you do to reduce air pollution?

1. Encourage your family to use neighborhood market
2. Whenever possible take your bicycle.
3. As far as possible use public forms of transport.
4. Encourage your family to form a carpool to office and back
5. Reduce the use of aerosols in the household
6. Look after the trees in your neighbourhood.
7. Switch-off all the lights and fans when not required.
8. If possible share your room with others when the air conditioner, cooler or fan is on.
9. Do not burn leaves in your garden, put them in a compost pit.
10. Make sure that the pollution check for your family car is done at regular intervals.
11. Cars should, as far as possible, be fitted with catalytic converters.
12. Use only unleaded petrol.

Smog is caused by many factors, Major producers of smog include automobiles, fires, waste treatment, oil production, industrial solutions, paints and coatings. The articulates present in smog include carbon monoxide, dirt, dust and ozone. The smog effect is created when sunlight,

hydrocarbons and nitrogen oxide are mixed together Smog creates harmful health hazards like lung failure and pneumobias.

Smog is not only a city problem. As smog level increases, wind carry smog away from urban areas and harm other areas too. Agriculture is also affected by smog.

2. Water Pollution

Water pollution is any chemical, physical or biological change in the quality of water that has a harmful effect on any living that drinks or uses or lives in it.

Major water pollutants

There are several causes of water pollution. The first are **disease-causing agents**. These are bacteria, viruses, protozoa and parasitic worms that enter sewage-systems and untreated waste.

Second pollutant is **oxygen demanding bacteria**; that is, wastes that can be decomposed by oxygen requiring bacteria. Large proportion of such bacteria in water can deplete oxygen levels in it. This causes other organisms in the water such as fish to die.

The third class of water pollutants is **water soluble inorganic pollutants** such as acids, salts and toxic metals.

Water can also be polluted by a number of **organic compounds** such as oil, plastics and pesticides in the water which are harmful to humans and animals.

Water is able to transport pollution from one location to another easily. Every year 6,356,00 tonnes of sewage, sludge and garbage are dumped into the world oceans. “400million people live along the Ganges river. Further, 2,000,000 persons ritually take bath daily in the river. It is filled with chemical wastes, sewage and even the remains of human and animals.

The National Ganga River Basin Authority is allocated Rs.5000 million by National Clean Energy Fund (NCEF) for its innovative project, of clearing of river

Ganga”.

Water pollution mainly affects the water based ecosystems. It also disrupts the natural food chain. Pollutants such as lead and cadmium are eaten by tiny animals. These animals are later consumed by fish and shellfish. So, the food chain continues to be disrupted at all higher levels. People can get diseases such as hepatitis by eating sea foods.

Toxic substances entering into lakes, streams, oceans, dissolve in water and get deposited on the bed. This affects aquatic ecosystems. This can also seep down and affects the ground water.

Eutrophication

Eutrophication is the ecosystem response to the addition of artificial or natural substances, mainly phosphates, through detergents, fertilizers, or sewage, to an aquatic system. Negative environmental effects include hypoxia, the depletion of oxygen in the water, which causes a reduction in specific fish and other animals.

3. Land Pollution

Land pollution is contaminating the land surface of the earth through dumping or urban waste matter and it arises from the breakage of underground storage tanks, application of pesticides and percolation of contaminated surface water, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil.

How can land pollution be prevented

Things used for domestic purpose can be reused and recycled.

Organic waste matter should be disposed off far ways from the residential places.

Inorganic wastes can be separated, reclaimed and recycled.

4. Noise Pollution

Human or machine created sound that disrupts the activity or balance of human or animal life is known as noise pollution.

The unwanted sound can damage physical and psychological health.

Noise pollution can cause hypertension, high stress levels, hearing loss, sleep disturbances and other harmful effects.

Control measures of noise pollution

Development of a green belt vegetation to reduce noise.

Installation of decibel meters along highways and in places of public gatherings.

Development of plantations- A strip of wide plantation inside the compound wall effectively protects houses, school and hospitals.

5. Biomedical Waste

Pollution due to biomedical waste is likely to spread diseases dangerous to life. In early April 2010, a machine from Delhi University containing cobalt-60-a radio active metal used for radiotherapy in hospitals, sent to a scrap yard in the city. The death from radiation of a scrap yard worker revealed the reasons as the biomedical wastes.

6. Electronic Waste(e-waste)

Unusable electronic goods are called as an Electronic waste (e-waste).

India produces about 3,80,000 tonnes of e-wastes generated out of television sets, mobile phones, computers, refrigerators and printers. This is a major threat to the environment and could lead to dangerous radiation-related catastrophes worldwide.

7. Mining Waste

Mining is a major contributor to environmental pollution.

The mines of the Mahanadi coal fields and NTPC draws about 250

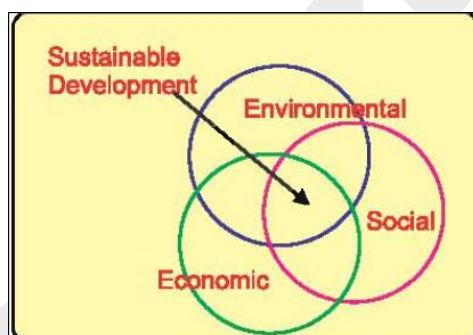
million litres of water per day from river Brahmani and, in return, they release

thousands of gallons of waste water which contains harmful substances like ash, oil, heavy metals, grease, fluorides, phosphorous, ammonia, urea and sulphuric acid into the river Nadi.

Due to large scale mining in the Aravalli hills in Rajasthan and Haryana, the forest cover has been depleted 90 per cent and drying up wells and affecting agriculture.

Bio diversity

Bio diversity is the degree of variation of life forms within a given eco system. On the entire planet, rapid environmental changes due to mining and dam constructions cause extinctions.



Sustainable Development

Many of India's environmental problems are a result of the very high density of population. So, it is everyone's responsibility to preserve our environment and also keep it healthy and sustainable.

- ✓ It is possible by using efficient and eco-friendly technology.
- ✓ Adoption of Indigenous agricultural practices, soil and water conservation practices.
- ✓ Community participation for ecological sustenance is indispensable for conservation of environment.

Geography Notes Part 31

India - Trade, Transport and Communication

India is a vast land with beautiful landscape and rich abundant resources. But, the resources are not uniformly spread, and so, there are regions of surplus resources and regions of deficit. This leads to movement of goods from the surplus region to the deficit region through trade. Hence, **trade is an act or process of buying, selling or exchanging goods and services.** Growth of trade leads to economic prosperity of a nation. But, trade growth depends on well developed market, advanced transport and communication system. Thus trade, transport and communication stand complementary to each other and their overall development is essential for the country's economic growth.

Trade in general is of two types. They are **Internal trade** and **International trade**.

Internal trade, also known as local trade, is carried within the domestic territory of a country.

Land transport plays a major role in the movement of goods and this trade is mostly based on the nation's currency. It helps to promote a balanced regional growth in the country. For example tea from Assam, coffee from Karnataka, spices from Kerala, minerals from Jharkhand, West Bengal, Orissa belt are supplied to different parts of our country.

International trade also known as external trade, is a trade carried on between two or more countries. Ocean transport plays a major role in the movement of goods and the trade is carried on foreign currency. It leads to rapid economic progress of a country.

For example, India supplies iron ore to Japan. International trade is sub divided into two types such as **1. Bilateral trade** **2. Multilateral trade.**

1. Bilateral trade is a trade carried out between two countries based on the

agreement deal of not using currency for payment. In this trade a country sells its surplus goods to a needy country and in return buys an equally valuable required goods from the same country.

2. Multilateral trade is a trade carried out between many countries. In this trade a country sells its surplus goods to the needy country by getting revenue and buys the required goods from another country by using the same revenue. This trade is very complicate to negotiate, but stands very powerful when all the countries sign the agreement. All member countries are treated equally in the multilateral trade. The Trade Blocs like **APEC(Asian Pacific Economic Community)**, **ASEAN(Association of South East Asian Nations)** and **SAPTA(South Asian Preferential Trade Agreement)** are created to make the trade easier.

Components of Trade

“**Export**” and “**Import**” are two components of trade. ‘**Export**’ means goods and services sold for foreign currency. India exports nearly 7500 goods to nearly 190 countries of the world. **Import** refers to goods and services bought from overseas producers. India imports nearly 6000 goods from 140 countries.

The difference between the values of export and import is called **Balance of trade**.

If the value of export in a country is higher than the value of import, then the trade in that country will be called as **favourable balance of trade**. For example Japan.

If the value of import in a country is higher than the value of export then the trade in that country will be called as **unfavourable balance of trade** in that country. For example India

The value of currency of a country depends upon the balance of trade of that country

Major Exports from India

i) Agriculture Products

Cereals, pulses, tea, coffee, spices, nuts and seeds, sugar and molasses, processed food, meat and meat products.

ii) Oreas and minerals

Iron ore, Coal, Manganese, Mica, Bauxite.

iii) Leather products

Wallets, purses, pouches, handbags, belts, footwear, gloves.

iv) Gems and jewellery

Precious stones, gold jewellery, decorations and antiques.

v) Chemicals and related products

Pharmaceuticals, cosmetics, rubber and glass.

vi) Engineering goods

Machinery, iron and steel, electronic goods, computer software.

vii) Textiles and handicrafts

Ready made garments, cotton, yarn and zari goods.

Major imports of India

Machineries like transport equipment, machine tools, non-electrical machineries, electrical machineries. Wheat, medical and pharmaceutical products, Petroleum fertilizers and newsprint.

India's value of imports and exports in 1950-51 was Rs. 580 Crores and Rs. 607 Crores respectively. However, in 2012-2013, India recorded imports valued at 590.6 billion US dollars and exports at 464.2 billion US dollars.

This clearly indicates the significant growth of both exports and imports in India.

India's International trade reflects the growing prominence of Indian economy in the global market. Since 2004, a liberal trade policy has been followed by the Government of India to promote International trade.

Highlights of India's International Trade Policy

Merchandise trade has been doubled

Thrust is given for employment generation, especially in semi-urban and rural

areas.

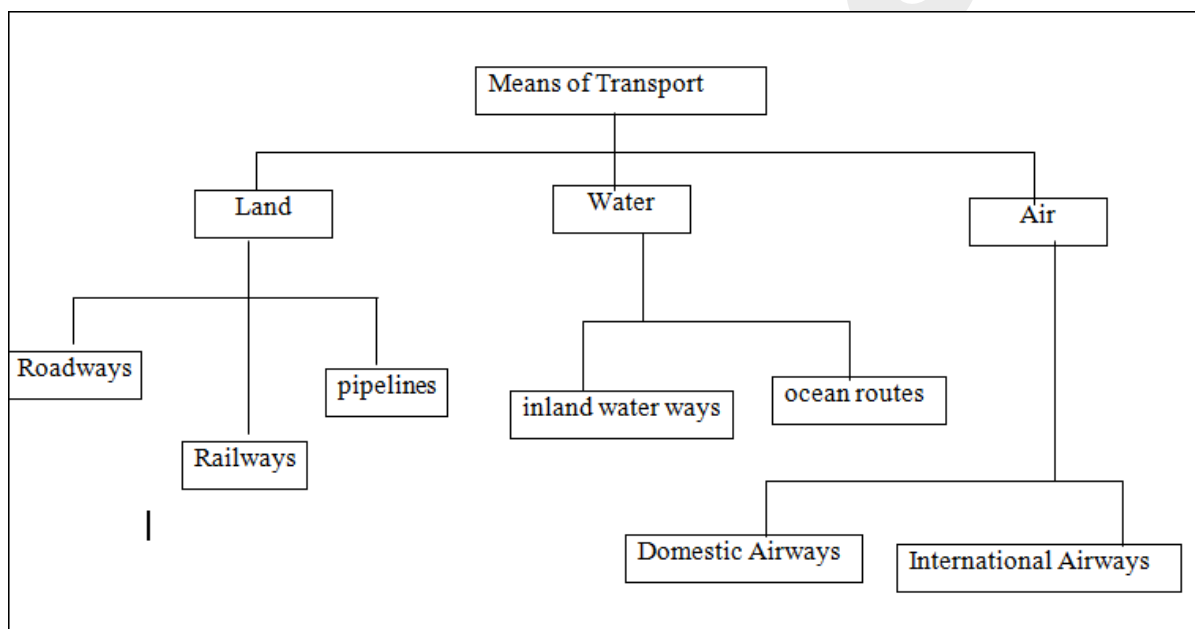
Trade procedure is simplified and transaction cost is reduced.

Special focus is given to make India a global hub.

A new scheme called Vishesh Krishi Yojna has been introduced to boost exports of fruits, vegetables, flowers and minor forest products.

Transport System Of India

Development of a country not only depends upon the production of goods and



Services but also on an efficient means of transport. It helps to move the materials to the point of production and goods to the point of consumption (market). A dense and efficient network of transport is essential to promote **social cohesion** and to **accelerate economic prosperity**. It also ensures security and territorial integrity. India is closely connected with the world countries by means of fast moving transport and an equally developed communication system.

Roadways

The Indian Roads are cost efficient and the most popular dominant mode of transport linking different parts of our country. Roads stretch across the length and breadth of our country. It is used by all sections of people in the society. Road network in India is the **second longest** in the world accounting for 3.314 million km. the roads are classified into Village roads, District roads, State Highway, National Highway, Golden Quadrilateral Super Highways, Expressways, Border Roads and International Highways.

Village Roads link different villages with towns. They are maintained by village panchayats. In India villages roads run to a length of 26,50,000 Kms.

District Roads links the towns with the district headquarters. They are maintained by the Corporations and Municipalities. in India run to a total length of 4,67,763 kms of district roads.

State Highways links the state capitals with the different district headquarters. The roads are constructed and maintained by the State Public Works Department (SPWD). The State Highways runs to a length of 1,31,899 kms. Cuddalore- Chittor Road is an example for State Highways.

National Highways links the state capitals with national capital. They are the primary road system of our country and are maintained by the Central Public Works Department.(CPWD) It runs to a length of 92, 851 kms.

For example, NH 47 is a National Highways which connects Tamil Nadu and Kerala. The total length of the road is 650 km out of which 224 km runs in the state of Tamil Nadu.

The shortest National Highway is NH 47A. It runs from Ernakulam to Kochi port covering a distance of 5.9km.

The longest National Highway NH 7, it runs from Varanasi in Uttar Pradesh to Kanyakumari in Tamil Nadu covering the distance of 2369 km. It passes through some of the important metros like Jabalpur, Nagpur, Hyderabad and Bengaluru.

“**Golden Quadrilateral Super Highways**” is a major road development project launched by the Government of India. It runs to a length of 14,846 km connecting the major cities of India. It includes:

- **Six lanes super highways** running to a length of 5846 km connecting the four metropolitan cities- Chennai, Mumbai, Delhi and Kolkata.
- **North –South corridor** linking Srinagar-Kanyakumari, East-West corridor connecting Silchar-Porbander, run to a total length of 7300 Km.
- The roads that connect the major ports with Golden Quadrilateral and the corridors run to a length of 363 km.

The main objective of the Golden Quadrilateral Super Highways is providing ‘**Connectivity**’ ‘**speed**’ and ‘**safety**’. They are meant to reduce the travel time and link the metropolitans closer. These projects are implemented by the **NHAI** (National Highway Authority of India).

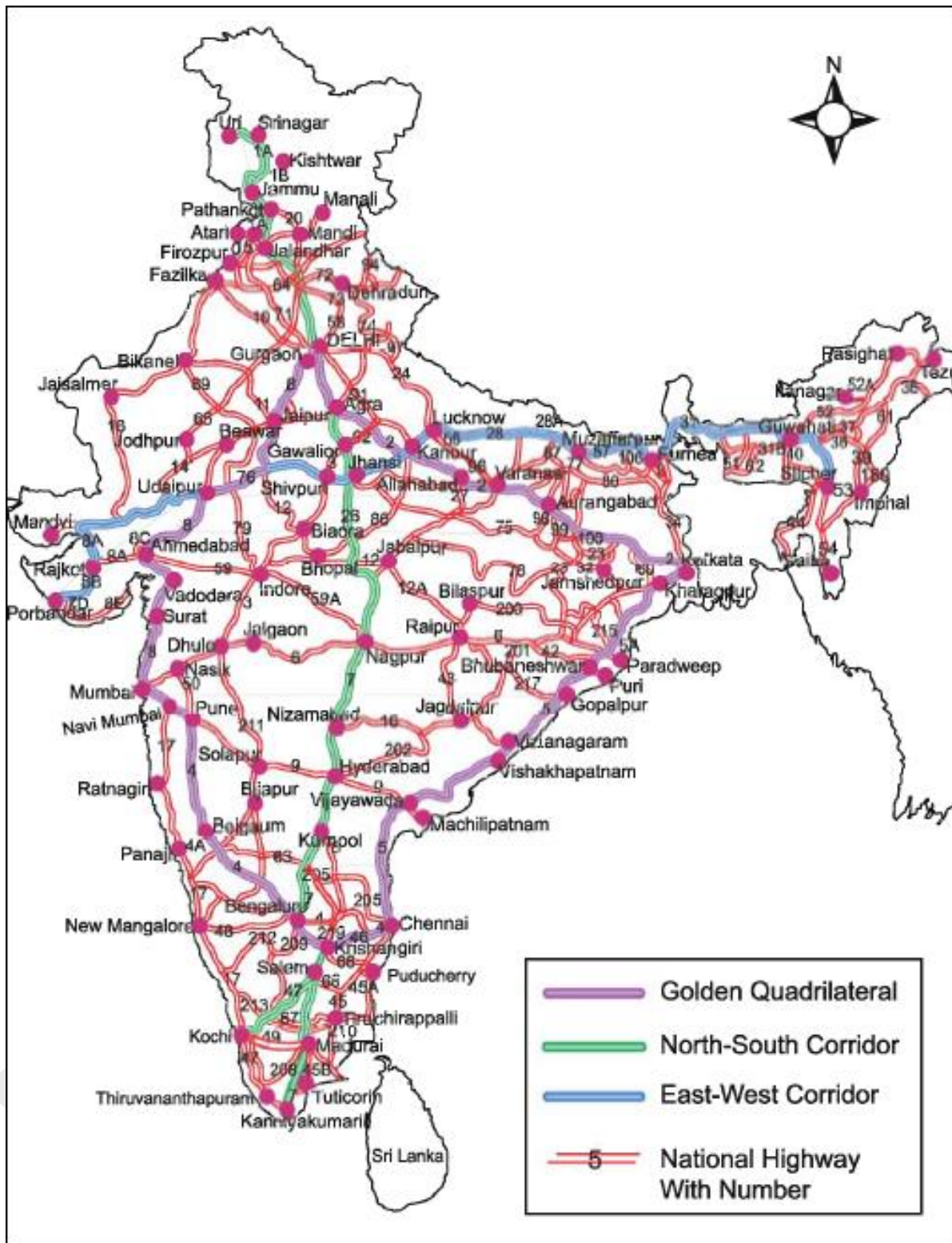
As this Project involves huge investment, the government has entrusted private sector companies to invest, develop and maintain these highways. The agreement for the construction of roads is based on the concept of **Build, Operate and Transfer (BOT)**. After the private companies realize their cost and profits over an agreed period, the responsibilities will be transferred to the government.

Expressways are the technologically improved high class roads in the Indian Road Network. They are six lane roads. They run to a length of more than 200 kms. New Mumbai-Pune Road is an example for Expressway.

Border Roads

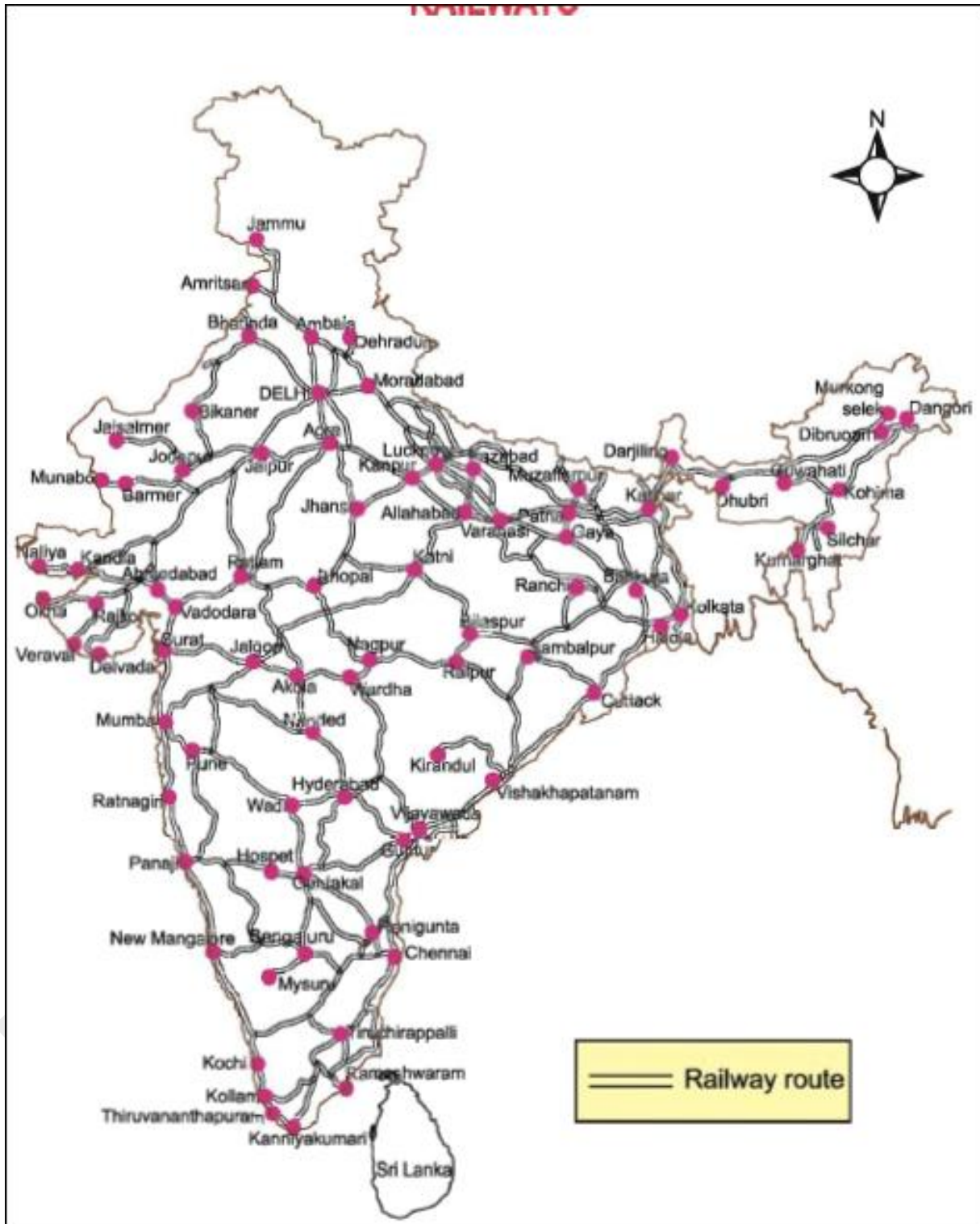
Border Roads are the roads constructed along the northern and north eastern borders of our country.

National Highways



India

Railways



These roads are constructed and maintained by **Border Roads Organization(BRO)** which was setup in 1960 by the Government of India. BRO is regarded as a symbol of nation building, national integration and an inseparable component in maintaining the security of the country. The organization has constructed 46,780 Km of roads in difficult terrain.

Border Road Organization has constructed the world's highest road connecting Manali (H.P) to Leh (Kashmir) at an altitude of 4270 mts.

International Highways are the roads that link India neighbouring countries for promoting harmonious relationship with them.

Railways

The Railways in India provide the principal mode of transportation for freight and passengers. It brings people together from the farthest corner of the country and promotes trade, tourism, education and national integration.

The First train steamed off from Mumbai to Thane in 1853, covering a distance of 34 km.

Bhopal Shatabdi is the fastest train in India. It runs at a speed of 150 km/hr. between Bhopal Junction and New Delhi.

Railway made a modest beginning in India in 1853. By 1947, they had grown to 42 rail systems managed by 37 companies. In 1951, the systems were nationalized as one unit-“ The Indian Railways”.

Indian Railway is the fifth largest in the world and the second largest in Asia(USA, Russia, Canada, China). It traverses across the length and breadth of the country for over 63,273 km connecting 7,025 stations.

Railways help in commuting 20 million passengers and more than 2 million tonnes of freight daily. New Delhi is the headquarters of the Indian Railways and it is the main focal point from where the railway lines radiate in all directions connecting the seaports, airports and metropolitan cities of India. The network runs on the multigauge operation. They are:

1. Broad Gauge (1.676 mts)
2. Meter Gauge (1.00 mts)
3. Narrow Gauge (0.672 mts)

The Indian Railways is divided into 17 zones

Zones	Headquarters
Central Railway	Mumbai
Eastern Railway	Kolkata
East Central Railway	Patna-Hajipur
East Coast Railway	Bhubaneswar
Konkan Railway Corporation	Navi Mumbai
Northern Railway	New Delhi
North Central Railway	Allahabad
North Western Railway	Jaipur
North Eastern Railway	Gorakhpur
North East Frontier Railway	Maligaon(Guwahati)
Southern Railway	Chennai
South Central Railway	Secunderabad
South Eastern Railway	Kolkata
South East Central Railway	Bilaspur, CG
South Western Railway	Hubli
Western Railway	Mumbai
West Central Railway	Jabalpur

The Role of Physiography in Railway System

The physiography of India has played a major role in the distribution of Railway network.

- The **Himalayan region** has rugged terrain and so it is very difficult to lay railway tracks along the steep slopes. Hence, this region has only three railway lines.
- Further, the condition in west **Rajasthan**, frequent flood in Brahmaputra valley thick forest and rough terrain in Northeast India has led to a few railway lines in these region.
- The **northern plains** of India is a flat land with rich alluvial soil. It has highly developed agricultural and industrial sectors with high population. Hence, it has a dense network of railways.
- **Peninsular India** is a plateau region with an undulated terrain, hence it has a moderate railway network.

Suburban Railway

Cities in India such as **Mumbai, Chennai, Kolkata** and **Delhi** have separate tracks for the suburban network, whereas Lucknow, Kanpur, Hyderabad and Pune do not have separate suburban tracks but share the track of long distance trains. The suburban trains connect the **commuters** of suburban areas to the urban centres. They are mostly Electric Multiple Units(EMU). These trains usually have nine coaches but to avoid overcrowd, during peak hours they attach extra coaches.

MRTS and METRO RAIL – Chennai

The **Mass Rapid Transit system (MRTS)** is an elevated line of the suburban railway in Chennai. This railway line currently runs from **Chennai Beach to Velachery**, covering 17 stations for a distance of 25 km.

In 2015 Metro Rail Transport introduced in Chennai from Koyambedu to Alandur.

Role of Railways in Indian Economy

- Railways help in **bulk Movement** of goods (iron and steel, mineral oil, building stone coal, metal ores etc) at large.
- Railways help in the **commercialization** of the agriculture sector by facilitating quick movement of perishable items like milk, vegetables, fruits etc.
- Railways help in developing a **unified national market**, equalization of prices and also in the growth of internal and foreign trade.
- Railways help in **controlling famines** by quick movement of essential commodities.
- Railways play a greater role in **administration** and in national integration.

Pipelines

Pipelines were used for transporting water to cities in earlier days, but now they are also used for transporting crude oil and natural gas from oil and natural gas fields to oil refineries, fertilizer factories and big thermal power plants.

Advantages of Pipeline Transport

- Pipeline can be laid through **difficult terrain** as well as **under water**.
- Initial cost laying pipeline is high but subsequent cost for maintenance and operation is **low**.
- It ensures **steady supply** and minimizes **transshipment losses** and delays.
- Pipeline operation involves very **low consumption of energy**.

There are three important pipeline network in our country.

1. From oil fields in **upper Assam** to Kanpur in Uttarpradesh via Guwahati, Barauni and Allahabad.
2. From **Salaya in Gujarat** to Jalandhar in Punjab Via. Viramagam, Mathura, Delhi and Sonipat.
3. Gas pipeline from **Hazira in Gujarat** connects Jagdishpur in Uttarpradesh Via. Vijaipur in Madhya Pradesh.

Apart from the above, pipelines are also laid connecting, Mumbai high and

Mumbai; Mumbai and Pune.

Waterways

Waterways are the **cheapest** means of transport. They are most suitable for carrying heavy and bulky goods at low cost. It is a fuel efficient and environment friendly mode of transport.

Waterways are classified into Inland waterways and Ocean routes.

Inland Waterways

India has an **extensive network** of inland waterways in the form of **rivers, canals** and **backwaters**. The total navigable length is 14500 km. Out of which 5685 km of rivers and 400 km of canals are used by mechanized crafts. The **“Waterways Authority”** of India has identified five National Waterways they are:

National waterway 1: Allahab- Haldia stretch of Ganga.

National waterway 2: Saidiya – Dhubri stretch of the Brahmaputra.

National waterway 3: Kollam-Kottapuram stretch of the west coast canal, Champakara canal and Udyogmandal canal.

National waterway 4: Bhadrachalam – Rajahmundry and Wazirabad Vijawada stretch of the Krishna Godavari river system along with Kakinad Puducherry canal network.

National waterway 5: Mangalgadi – Paradeep and Talcher – Dhamara Stretch of the Mahanadi, Brahmani river along with the east coast canal.

Ocean Routes

India has a **long coast** line of 7516 km with 13 major and 187 medium and minor ports located along the coast. These ports handle 95 percent of the country's foreign trade. The major ports are managed and controlled by **‘Port Trust’** under the Government of India.

The medium and minor ports are controlled by the State Governments. The major ports the **west coast** are Kandla, Mumbai, Jawaharlal Nehru, Marmagao, New Mangalore and Cochin. The

major ports along the **east coast** are Tuticorin, Chennai, Ennore, Vishakapatnam, Paradip, Haldia and Kolkata.

India is the second largest ship owning country in Asia and ranks sixteenth in the world. India has four major ship building yards. They are:

1. **Hindustan shipyard at Vishakapatnam**
2. **Garden reach workshop at Kolkata.**
3. **Mazagaon Dock at Mumbai.**
4. **Kochi shipyard at Kochi.**

Government of India has issued guidelines for private investment in the port sectors. **Indian ports Act 1908** and **major port Trust Act 1963** have been made flexible to allow private investment in ports.

Airways

Airways is the quickest, costliest, most modern and comfortable means of transport. They carry passengers, freight and mail. They link local, regional, national and international cities. Air transport has made accessibility easier by connecting difficult terrains like high mountains and sandy deserts.

The air transport in India made its beginning in 1911, but the real initiation was made in 1932 by JRD. Tata, when he started the **Tata Airline**. In 1946 it was renamed as **Air India** and in 1953 air transport was nationalized. **Indian Airlines** was set up to cater the needs of domestic market while **Air India** was set up to take care of the international sector. Both enjoyed monopoly over Indian skies until 1986 later, due to **liberalization policy**, many privately owned airlines joined the air transport system.

In 2007, the Government of India merged the Air India and Indian Airlines under **National Aviation Corporation of India Limited (NACIL)**. NACIL(A) provides international services, **NACIL(I)** provides domestic services and services to neighbouring countries in South East Asia and Middle East.

NACIL operates 159 Airbuses and Boeing aircrafts. It plays a major role in connecting Indian cities with the major cities of the world. Apart from NACIL there are **private operators** namely , **Jet Airways, Spice jet, Inter Globe Aviation(INDIGO)** to provide domestic services.

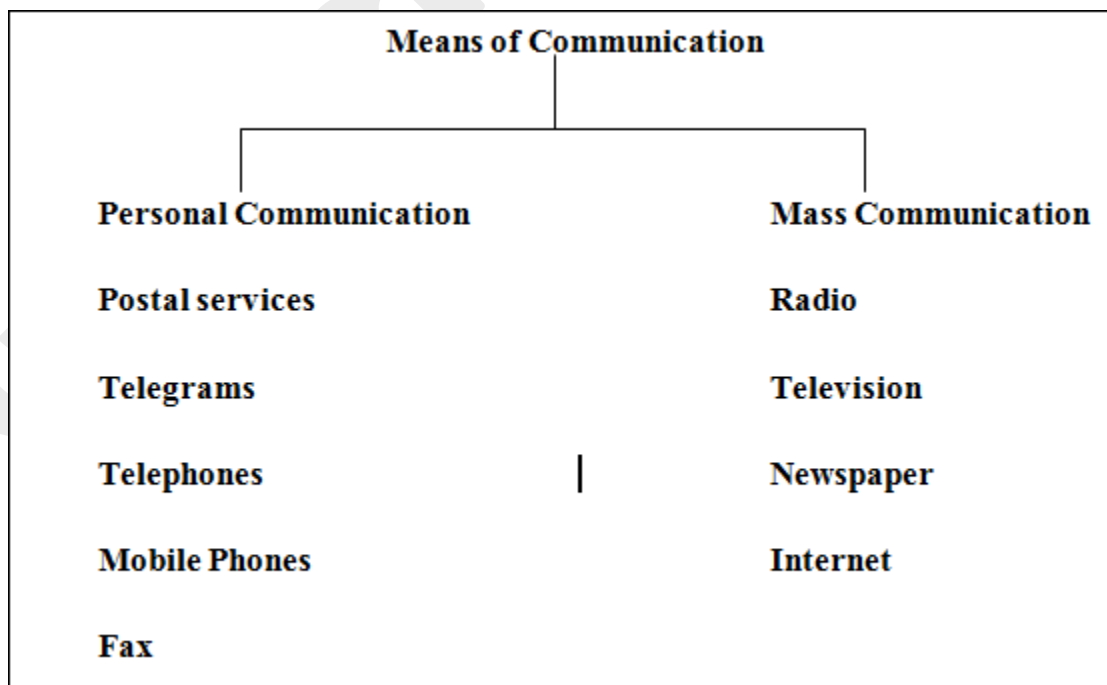
Airport Authority of India(AAI) was constituted in 1995 and it has instituted international standards of safety to Indian Airports. At present, AAI maintains and operates 129 airports out of which 17 are International Airports.

Pawan-Hans Helicopter Ltd. is a public sector company. It is engaged in providing helicopter services to ONGC for its offshore operations. It also provides services to various state Governments, especially in the North East to link the inaccessible areas.

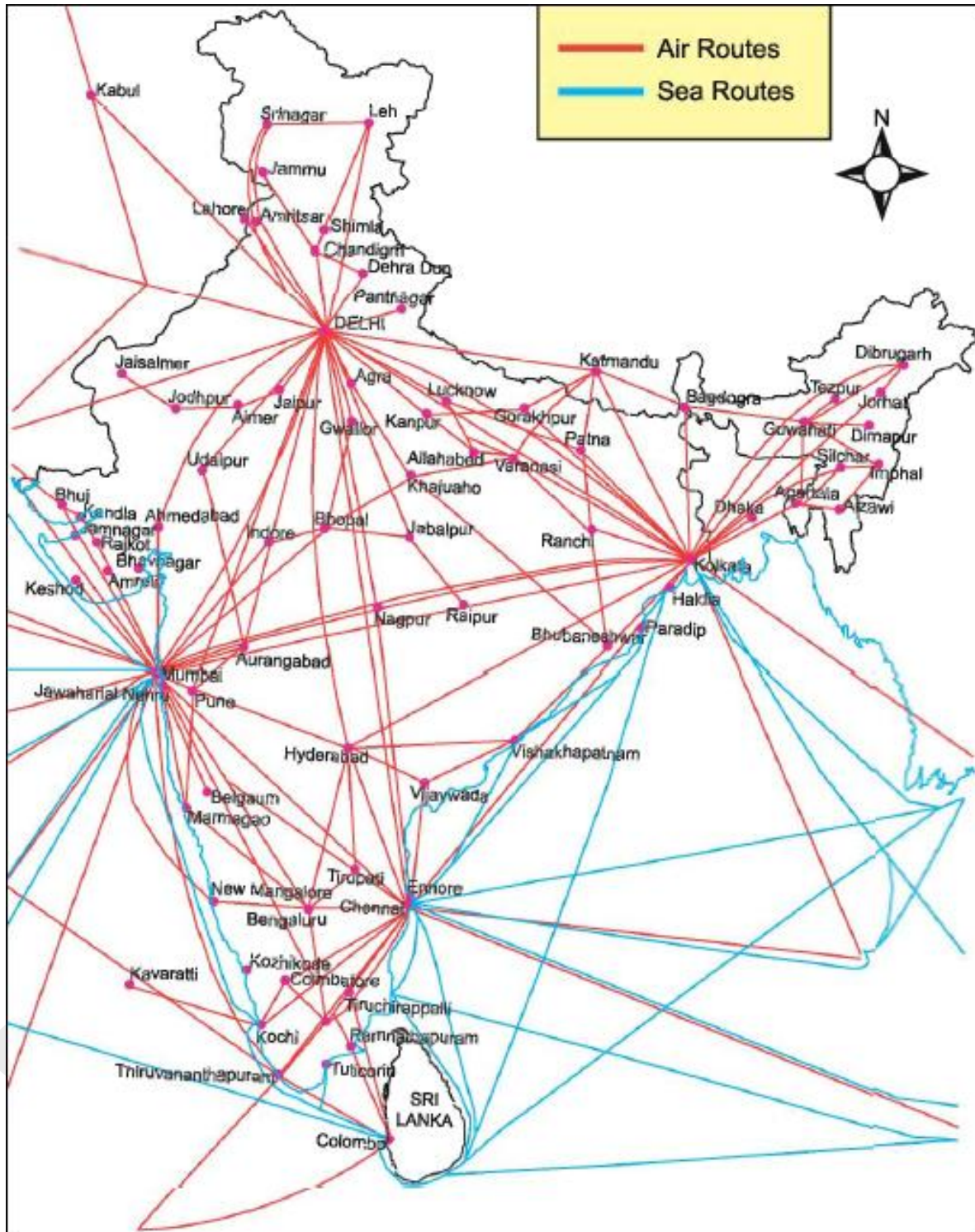
Communication

Communication system contributes to the development of economy and social relationships. It helps in promoting **cultural unity**.

Communication is a process that involves exchange of information, thoughts and ideas. There are various ways of sharing information with each other and it is termed as the '**Means of Communication**'.



Major Sea and Air Routes



I) **Personal Communication** refers to exchanging of information between two persons.

1. Postal Service

By the implementation of Indian Postal Act, 1837 our Postal service has become the largest in the world. It enables people to send parcels and mails to foreign lands and to the remotest villages. The mails are classified into **first class mail and second class mail**. First class mail includes postcards, inland letters and envelopes. They are airlifted without any surcharge between stations. The second class mail includes book packets, registered newspaper and periodicals. They are carried by land transport. They also provide **Value Payable Post(VPP)** service, Electronic Money Order service, Instant Money Order service, e-Post and e-Bill Post service, Express parcel post and Speed post services.

India has the largest postal network in the world with 1,55,618 post offices.

2. Telegram

Telegram is a form of **written** communication by which messages can be set quickly to distant places.

3. Telephone

Telephone is a form of **oral communication**. It is considered very essential for the growth of commerce. People at distant places within a country can communicate using STD (Subscriber's Trunk Dialling), while international communication can be made through ISD(International Subscriber Dialing). A sophisticated telephone not only enables voice messages but also written messages, drawings, photographs and video images. Telephone is the most preferred form because it provides instant communication.

4. Mobile phones

Mobile phones are an integral part of our lives today. Mobile phones help us to

connect with people even when we are on the move and mobile connectivity today includes even remote rural and hilly areas.

Short Message Services(SMS) is a method by which message can be sent to a mobile phone via another mobile phone. SMS may be set from one cell phone to another, or may be set to all cell phones within a specific geographical region.

5. Fax

Fax is an electronic device that enables instant transmission of any matter, which may be handwritten or printed like letters, diagrams, graphs and sketches by using telephone lines. A fax machine, sends the exact copy of the document to another fax machine at the receiving end. **Internet fax** is a form for sending documents using internet with the help of a fax machine.

II) Mass Communication enables millions of people to get the information at the same time. It helps in creating awareness among the people regarding various national policies and programme.

1. Radio

Radio broadcast in India was started in 1927. In 1936 it was named as **All India**

Radio(AIR) and from 1957, it came to be called as **Akashvani**. It serves as an effective medium to educate people on health, environment protection , family planning, science and technology.

2. Television

Television in India is known as **Doordarshan** and it is one of the largest terrestrial networks in the world. It offers three-tier program services(national, regional, local) for various categories of people. It brings its viewers all the major programmes of national and international importance through live telecast. It broadcasts a variety of programmes from

entertainment, education, sports, and health hazards for people of different age groups and regions.

3. Newspapers

Newspapers are a most common but powerful means of communication which provides information about national and international events to the people. In a democratic country like India, they serve as a very **effective tool** for knowing public views and opinions.

4. Internet

Internet is a vast network of computers. It connects many of the world's business institutions and individuals. Internet means inter connected network of net works, which links thousands of smaller computer networks. It enables computer users throughout the world to send and receive messages and information in a variety of form. It was first started as a purely text based system to send and receive message(e-mail), but now, it is fully a **multi media based system** with capacity to deliver picture images, video and audio. The basic services of internet are e-mail, The World Wide Web(WWW) and Internet Phone.

Advantages of Communication Network

- Communication network has enhanced the efficiency of communication.

because it enables quick exchange of information with people anywhere in the world.

- Leads to enormous growth of trade.
- Helps the government to tackle various socio-economic problems in the society.
- Improves the quality of human life.
- Opens the door to the information age.
- Promotes Edusat programs.

In recent decades, the world has taken giant strides into the information age.

The diversity and the capabilities of various media-(print and electronics) have increased enormously and they play a significant role in the economic and social growth of our country.

Geography Notes Part 32

Remote Sensing

Geography is the study of the **Earth focusing on its surface, the Atmosphere, oceans, plants, animals, and people**. Most people think that geography is a study of **maps**. This thinking is only partially correct because Geography is also the study of man's natural environment and its influence on cultural environment. To learn and know about our environment, we use our senses of seeing, touching, smelling and hearing. These senses help us to learn about an object from close proximity. But in geography the subject matter encompasses spatial distribution and so it takes many months, to study about resources of a region by means of ground survey. Ground survey of resources is hindered by dense forests, rugged terrain, sandy deserts and unpredictable weather. In spite of this, continuous monitoring of the earth surface has become very essential due to recent increase in natural disasters, large scale climatic changes, desertification and reduction in biodiversity. Hence, the most effective technology to gather information on any part of the earth within a short span of time without footing the region is the Remote Sensing Technology.

What is Remote Sensing?

Remote = far away

Sensing = getting information

Remote sensing can be defined as the **collection of data about an object from a distance**. Humans and many other animals accomplish this task with their eyes or by their sense of smell or hearing. Geographers use the remote sensing as a tool to monitor or measure phenomena on the Earth's **lithosphere**, hydrosphere, **atmosphere** and biosphere. Remote sensing of the environment by geographers is usually done with the help of mechanical devices known as **sensors**. These sensors have a greatly improved ability to receive and record information about an

Earth object without any physical contact. Often, these sensors are positioned in helicopters, planes, and satellites. The sensors record information about an object by measuring the **electromagnetic energy that is reflected back** and **radiated** from the object on the earth surface.

Development of Remote Sensing

Aerial photographs were the first results of remote sensing utilized by cartographers, or map-makers. In 1858, French map-makers used a **hot air balloon** and primitive cameras to take oblique(inclined) aerial photographs of the landscape. Later during World War I, air planes were used to take systematic aerial images of much of the terrain in the war zone. These photographs helped in gathering information about the position and movement of enemy troops. After the war, systematic vertical images were taken for civilian use. By comparing photographs taken at different angles; cartographers were able to create accurate and detailed maps of different territories.

The process of comparing different aerial photographs and computing accurate measurements is called photogrammetry. Maps created using aerial photographs are called orthophoto maps.

In the 1960s, a revolution in remote sensing technology began with the deployment of space satellites. From their high vantage-point, satellites have a greatly extended view of the Earth's surface. The first meteorological satellite, TIROS-1(Television and Infrared Observation Satellite) was launched by the United States.

In the 1970s, the second revolution in remote sensing technology began with the launch of Earth Resource Technology Satellite(ERTS). This series was renamed **LANDSAT** in 1975. The usefulness of satellites for remote sensing has resulted in several other organizations launching their own devices. In 1986, the **SPOT (Satellite Pour l'Observation de la Terre)** program of France began. They launched five satellites and have produced more than 10 million images.

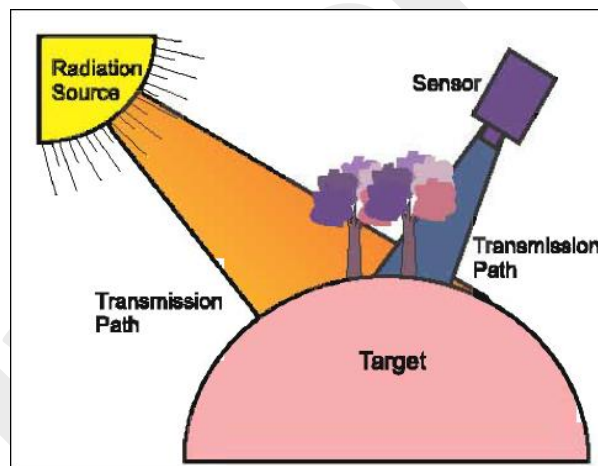
Components of Remote Sensing

The four basic components of a remote sensing system are **target**, **energy source**, **transmission path**, and a **sensor**. The **target** is an object or material that is being imaged. The components in the system work together to measure and record information about the target without actually coming into physical contact with it. The **energy source** provides electromagnetic energy to the target. Normally, the energy source can be classified into two.

1. **Passive System** (that is sun, irradiance from earth's materials)

2. **Active System** (that is irradiance from artificially generated energy sources such as radar).

Remote sensing technology makes use of a wide range electromagnetic spectrum from a very short wave Gamma ray to a very long radio wave. The electromagnetic radiation interacts with the target, depending on the properties of the target and the radiation; **transmit** information from the target to sensor. **Sensor** is a device to detect the **Electro Magnetic Radiation(EMR)**. Sensors can be classified on the basis of energy received into **Passive sensors** and **Active Sensor**.



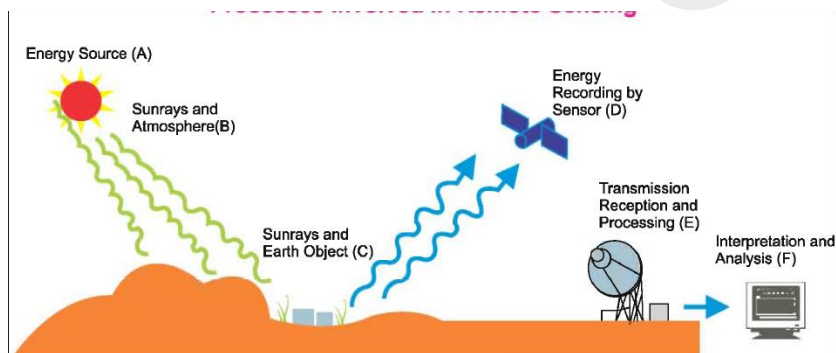
Passive sensors detect natural radiation that is emitted or reflected by the object or surrounding area being observed. For example Cameras used for taking favourite pictures during daylight. **Active sensors** transmit their own signal and measure the energy that is selected (or scattered back) from the target for example Radar.

Process Involved in Remote Sensing

1. **Sun is a Energy Source(A)**-the first requirement for remote sensing is energy source which illuminates or provides electromagnetic energy to the target of things.

2. **Sunrays and Atmosphere(B)**-as the energy travels from its source to the target, it will come into contact with, and also interact with, the atmosphere it passes through. This interaction may take place a second time as the energy travels from the target to the sensor.
3. **Sunrays and Objects on Earth(C)** – once energy makes its way to the target through atmosphere, it interacts with the target, depending on the properties such as tone, texture, size, shape and patterns of both the target and the radiation.
4. **Recording of Energy by the Sensor(D)**- after energy has been scattered or emitted from the target, the sensor(remote-not in contact with the target) collects and records the electromagnetic radiation.

Processes involved in Remote Sensing



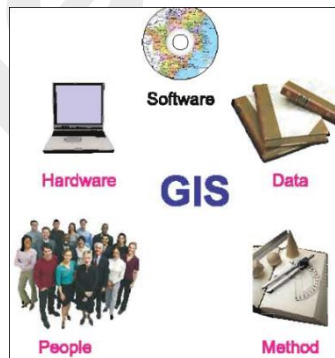
5. **Transmission, Reception and Processing(E)**- the energy recorded by the sensor has to be transmitted, often in electronic form, to a receiving and processing station where the data are processed into an image(hardcopy and / or digital)
6. **Interpretation and Analysis(F)**-the processed image is interpreted, visually or digitally or electronically, to extract information about the target which was illuminated.
7. **Application(G)**-the final element of the remote sensing process is achieved by applying the extracted information for better understanding and to reveal some new information, or assist in solving a particular problem.

Advantages of Remote Sensing

1. This system has the ability to provide a synoptic view of a wide area in a single frame.

2. Remote sensing systems detect features of inaccessible areas that cannot be reached by human vision. For example Equatorial forest in the congo basin, Africa.
3. Cheaper and rapid method of acquiring up to-date and continuous information over a geographical area For example: it helps agriculturists to identify the areas affected by pests, crops related diseases etc.
4. Helps the planners for formulating policies and programs to achieve the holistic functioning of the environment.
For example. Spots the areas of natural disasters such as tsunami, drought prone, flood affected and cyclone hit areas and helps in providing relief and rehabilitation program in the affected areas.
5. Enable the cartographers to prepare thematic maps like geological maps, soil maps, population maps etc. with great speed and accuracy.

Geographical Information System(GIS) is a systematic integration of Computer Hardware, Software and Spatial Data, for capturing, storing, displaying, updating, manipulating and analyzing all forms of geographically referenced data.



Components of GIS

A Geographic Information System combines computer drawn maps with a database management system. This diagram suggests that GIS consists of three subsystems:

- 1) an input system that allows for the collected data to be used and analyzed for some purpose; 2) computer hardware and software systems that store the data, allow for data management and analysis, and can be used to display products of data manipulation on a

computer monitor; and 3) an output system that generates hard copy of maps, images, and other types of output.

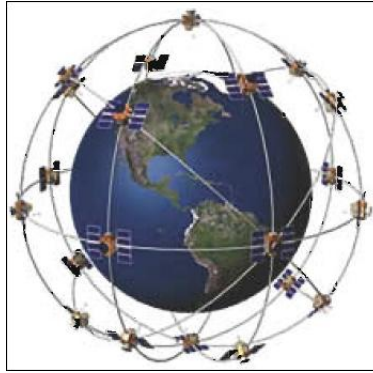
Application of GIS

GIS is used by people of various fields.

- **Exploration and mining** companies use GIS to find prospective areas for exploration and mining.
- **Power companies** use GIS to monitor and analyse the electricity load on the grid network for a particular area.
- **Transport companies** use GIS to locate shortest routes for delivering goods and to save time.
- **Law enforcement** agencies use GIS to map, visualize and analyse crime incident patterns.
- **Ecologists** use GIS to understand relationships between species distribution and habitats.

Global Positioning Systems (GPS)

GPS is a space-based **global navigation satellite system** that provides reliable **location** and time information in all weather and at all times. GPS was created and realized by the U.S. **Department of Defence** (DOD) and was originally run with 24 satellites. It was established in 1973 to overcome the limitations of previous navigation systems. GPS consists of three parts: the space segment, the control segment, and the user segment. The space segment is composed of 24 to 32 satellites in **medium Earth orbit** and also includes the boosters required to launch them into orbit. The control segment is composed of a master control station, an alternate master control station, and a host of dedicated and shared ground antennas and monitor stations. The user segment is composed of hundreds of thousands of U.S. and allied military users of the secure GPS Precise Positioning Service, and tens of millions of civil, commercial, and scientific users of the Standard Positioning Service.



GPS Satellite System

Basic concept of GPS

A GPS receiver calculates its position by precisely timing the signals sent by GPS **satellites** high above the Earth. Each satellite continually transmits messages that include, the time the message was transmitted and precise orbital information

Three satellites might seem enough to solve for position, since space has three dimensions and a position near the Earth's surface can be assumed. However, even a very small clock error multiplied by the very large **speed of light**, the speed at which satellite signals propagate, results in a large positional error. Therefore, receivers use four or more satellites to solve their location and time.

Application of GPS

GPS is considered a *dual-use* technology, meaning it has significant military and civilian applications.

- Surveying, Map-marking, Navigation, Cellular Telephony, and Geofencing are the main civilian use of GPS.
- Navigation, Target tracking, Missile and projectile guidance, Search and Rescue, and Reconnaissance are the main military use of GPS.
- GPS has become a widely used and a useful tool for **commerce, scientific uses, tracking and surveillance**. GPS' accurate timing facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids.

Farmers, surveyors, geologists and countless others perform their work more efficiently, safely, economically, and accurately, because GPS helps them with information.

Disaster Risk Reduction

In this chapter we will try to understand the ways to prevent catastrophic losses to human lives, livelihoods and economic and natural assets by understanding the comprehensive approach to reduce the risks and economic and natural assets by understanding the comprehensive approach to reduce the risks and negative impact of disasters on societies.

Why should we need Disaster Risk Reduction(DRR)?

A disaster's severity depends on how much impact a hazard makes on society and the environment. The impact in turn depends on the precautions we take to save our lives and our environment. The decisions should make us resilient to disasters.

Let us understand the definition of disaster risk reduction as defined by UNISDR '**The concept and practice of disaster risks through systematic efforts to analyse and manage the casual factors of disasters including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land environment, and improved preparedness for adverse events**'.

There are some important aspects of disaster risk reduction.

- Mitigation (Structural and non structural mitigation)
- Early Warning System
- Disaster Preparedness
- Recovery

Mitigation: mitigation and mitigation measures are practiced to reduce the frequency, scale, intensity, and impacts of disaster. Mitigation measures includes two general categories namely structural and non structural. Mitigation measures can be applied before, during and after a disaster.

Structural and non-structural measures:

Structural measures: This refers to any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems.

Non-structural measures: This refers to any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.

The Structural measures include construction of:

- Embankments or strengthening the embankments
- Designing electrical power systems to withstand weather and earthquake
- Enforcing strict building codes
- Seismic resistant designs of buildings
- Retrofitting public buildings to withstand
- Construction of houses away from hazardous areas
- Building community shelters at various hazard prone areas

The Non-Structural measures include:

- Management regulating measures such as zoning , coastal area management, hill side management, slope management, flood plain development restrictions, etc.,
- Community services
- Educational programmes
- Natural resource use regulations
- Policies on limiting the buildings of unsafe projects

Early Warning Systems

The term refers to the provision of information on an emergency to reduce the risks involved. This system exists for natural geophysical, biological hazards, socio political

emergencies, Industrial hazards and other related hazards. Without the early warning the training and evacuation methods can become irrelevant. Early warning system depends upon four main inter related elements.

1. Observation and recordings
2. Risk knowledge and recognition
3. Warning and Dissemination
4. Appropriate response

A weakness in any one of these could result in failure of whole system.

Tally Smith aged 10, was credited with saving hundreds of foreign tourists at Maichao Beach in Thailand, by alerting her parents and other people before the arrival of **Tsunami** caused by an earthquake in the Indian Ocean, in the year 2004. She recognized signs of Tsunami because she had learned about Tsunami in her school.

Disaster Preparedness:

It is programme of long term activities to manage all type of disaster related emergencies. The aim is to reduce the loss of lives and sufferings and to minimize the effects of disaster. Preparing for the disasters before they occur improves a community's ability to respond effectively and meaningfully. Capacity building will occur at all levels individual, social, national and global.

Some of the natural disasters like cyclone, hurricane, typhoon and tornadoes show some initial symptoms and thus give time to prepare. We can predict to a certain degree and get ourselves ready to face. Other events such as earthquake, fires, plane crashes, and terrorist attack etc., usually occur without warning. One of the major challenges is the vulnerability and protection of the physical infrastructure. All the governments have a safety and provide emergency relief in a crisis. High risk areas are most in need of preparation efforts.

The approach to disaster preparedness has shifted from **need based** approach to **rights and community based** approaches. This approach recognizes the rights of affected population in decision making and programme planning. Thus the vulnerability of individual can be substantially decreased. Disaster preparedness allows for quick and effective action.

Recovery: Decision and action taken after a disaster with a view to restoring or improving the condition as of the community and strengthen their capacity to cope with future disaster. It also ensures return to the normal situation and recovers equilibrium. The rehabilitation and reconstruction are the tasks in this stage and afford a valuable opportunity to develop and implement the measures of disaster risk reduction.

The community activity, school disaster management committee and education on disaster management play a vital role in reducing the severity of natural and man-made hazards. The Government of Tamil Nadu has initiated the disaster risk management programme with the support and guidance given by the United Nations Development Programme(UNDP). The main objective of the programme is to enhance the capacity of the local community by providing training on first aid, search and rescue, early warnings etc.,

The International Day for Disaster Reduction (IDDR) is celebrated on 13th of October every year.

The day encourages every citizen and government to take part in building more resilient communities and nations.

UNISDR – United Nations International Strategy for Disaster Reduction.

DRR – Disaster Risk Reduction

UNDP – United Nations Development Programme