**Indian Geography -- भारतीय भूगोल**

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# India Physical Geography

### Introduction

* + North-south expansion (3214 km) - 37deg 6min (N) to 8deg 4 min (N, mainland), 6 deg, 45 min (N, Andaman Nicobar islands)
  + East-west expansion (2933 km ) - 68deg, 7 min (E) to 97deg, 25 min (E)
  + Time meridian - 82deg 30 min E.
  + International land boundary - 15200 km
  + Mainland coastline is 6100 KM
  + Total coastline is 7516.6 km
  + 2.4% land of the world, 3.28 million sq. km./ 328 million hectare
  + 4% of water (freshwater)
  + 18% of world population

## Physical Aspects

**Geology of India**

* + Geology discusses about the timeframe and the structure of formation of a region. Hence, the geology of India talks of the regions which are geologically formed in different timeframes or at different times and also formed out of different processes and hence have a different structure internally as well as at the surface.
  + Hence, geologically India can be divided into -
    - The peninsular block which is the oldest formation nearly formed 550 million years before present.
    - Second, The Himalayas
    - Third, The Indo-ganga-Brahmaputra Plains, which are discussed below.

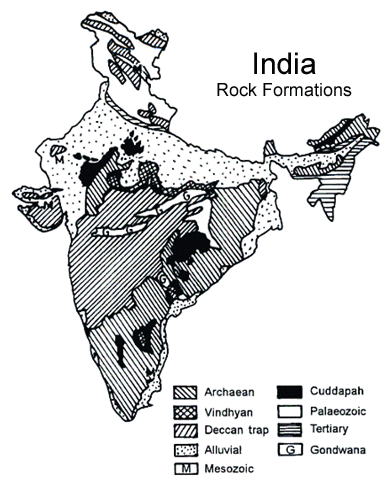
### The peninsular block

* + The peninsular block comprises of all the region which lies south of the Indo-Ganga-Brahmaputra plains and excluding the Purvanchal hills lying in Manipur Mizoram and Tripura. Hence, the peninsular block broadly includes the whole of the peninsula, Rajasthan desert region (which is over the peninsular block but not part of it), Meghalaya Plateau, Kargil Anglong Plateau.

#### *The Rock types of the region*

* + The peninsular block which was earlier part of Gondwana land was formed around more than 550 million years before present. Hence, is one of the oldest formations in the world. Because at that time fossil deposits was not there as life had still not evolved on land hence, in these oldest rocks of peninsular block we only find the metallic minerals or the abiotic non-metallic minerals such as lime stones etc.
  + Only when the peninsular block broke from the Gondwana land that during the Carboniferous period fossils of plants and animals were deposited in the rifted regions which are presently rich in fossil fuel minerals such as coal, oil, gas. Hence, overall the older parts of peninsular block gives only the mineral rich in metallic and non-fossil and non-metallic minerals whereas the later rocks gave us the fossil fuel minerals.
  + The peninsular block since its formation around 550 million years before present has not submerged below water (oceans since then) and has remained as a continental block.

**In terms of oldest to new -**

* + **Archean rocks**
    - The Archean rocks are found in the regions of Bengal, Bundelkhand, and the Nilgiris regions.
    - These are the oldest rocks in India
    - Mostly found - metallic minerals and non-fossil energy minerals such as Uranium.
  + **Dharwar rocks**
    - It is the second oldest rock regions
    - Regions - Bellari, Aravalli, Balaghat, Rewa, and Chhota Nagpur Plateau region.
    - Resources - Metallic and non-fossil energy minerals are found.
  + **Cudappah rocks**
    - Regions - Krishna River Valley, Nallamala region, Jodhpur region (West of Aravalli).
    - Resources - metallic minerals, Uranium, lime stone, sand stone and shale.
  + **Vindhyan rocks**
    - Regions - from Chittorgarh (west) to Sasaram (east)
    - Resources - lime stone and slate also precious jewel stones.
  + **Gondwana rocks (middle and upper carboniferous rocks)**
    - Regions - Valleys of Damodar, Mahanadi, Godavari and Krishna
    - Resources - Bituminous coal deposits
  + **Deccan trap rocks (basalt lava plateau)**
    - Regions - Maharashtra, Raajmahal hills
    - Resources - Black soil (or regur soil)
  + **Tertiary + Quaternary rocks**
    - Regions - coastal plains
    - Resources - not much mineral is found (newer rocks)
  + 

#### *Characteristics of Peninsular block*

* + Peninsular block is made up of ancient granite and Gneiss type of rocks standing above the sea level since Precambrian age, when there was no life on land.
  + It is **tectonically stable inactive region**since then (Precambrian) **except for** - the Western coastal plains that has submerged due to rifting from Africa while breaking of Gondwana land, upliftment of Western Ghats, upliftment of Eastern coastal plains, Rifting of Vindhya and Satpura forming rifts of Narmada, Tapi, Bima and Mahanadi rivers, Deccan Basalt lava plateau formation, Some earth quakes along minor hidden fault lines in peninsula e.g. Bhuj earthquake.
  + Rivers are mostly in mature and old stage
  + Mountains are mostly relict/residual mountains e.g. Aravalli, nallamala, Javadi, Palkonda etc.
  + The peninsular block remained as a part of Indo-Australian plate and moved with it after breaking from Gondwana land as discussed in continental drift theory. When the Indo-Australian plate collided with the Eurasian plate, the oceanic lithosphere (or Tethys sea subducted below the continental lithosphere of Eurasian plate leading to beginning of coastal folding of Eurasian plate and starting the formation of Trans-Himalayan ranges. Which was the beginning of the formation of the Northern mountains of India, starting around 65 mn years before present.
  + This was the beginning of the formation of the second geological region of India, the Himalayas.

### The Himalayas

**Sequence of formation**

* + Nearly 200 million year before present, the Indo-Australian plate started shifting northwards with the peninsular block over it as one continental crust, moving at the rate of 5-16 cm per year. The eastern part moving faster and western slightly slower.
  + Around 65 m years before present, while peninsular block was over the Reunion hotspot, causing the Deccan basalt lava plateau formation, the northern most part of the Indo-Australian plate having the Tethys Sea lithosphere at the margin, started subducting below the Eurasian plate, starting the formation of Trans-Himalayas along the margin.
  + Formation of Trans Himalayas starting with the Karakoram range around 65 m years before present, followed by the Ladakh range, then Zanskar range, and the Kailash range.
  + Around 58 m years before present, the peninsular block (continental lithosphere) collided with the Eurasian plate leading to continental-continental collision and slowing of the Trans-Himalayan formation due to folding of both the lithosphere south of the Trans Himalayan ranges - Greater Himalayan range started rising since 58 m years before present till 24 mybp.
  + Around 24 mybp, Middle Himalayas Range started rising while Greater Himalayas continued to rise. And this continued till nearly 5 mybp, when Outer Himalaya range started to rise while the other two (Greater and Middle) were still rising along with some rise of Trans Himalayan ranges..
  + This continued till nearly 10000 years before present and still continues to take place as the Himalayas are considered as young fold mountains and the tectonic plate movement is still taking place.
  + At the two locations where the Indian peninsula hits the Eurasian plate, two peaks of the Greater Himalayas are found - Nanga Paravat and Namcha Barwa as shown. We also understand that as the later mountains of Middle Himalayas and Greater Himalayas formed, simultaneously, the peninsular block was compressing more on the eastern side than the western side. Hence, the width of the three Himalayan ranges is lesser on the eastern side as compared to the western side. Height of peaks is relatively more and more frequent on the eastern side. Even the slope of each of the three ranges will be steeper on southern side and gentler on the northern side. The highest is the Greater Himalayas and lowest is the Outer Himalayas. There is also merging of Outer Himalaya with the Middle Himalayas in the eastern side, near Assam.

**Characteristics**

* + The Himalayas unlike the peninsular block are tectonically active and youthful ranges.

### The Indo-Ganga-Brahmaputra Plains

* + The Indo-Ganga-Brahma Putra plains are formed over the depression of the seafloor of the Tethys sea due to the compression of the region between the Eurasian continental plate on the north and the peninsular continental plate on the south. Because the sediments from the Himalayas due to erosion and also from the peninsular plateau deposited in the Tethys Sea depression. (Syncline depression)
  + Because the deposited material sand, silt, and clay are brought by the rivers Indus, Ganga, Brahmaputra and its tributaries coming from the Himalayas as well as Peninsula. Hence, the deposited material is known as an alluvial deposit.
  + Hence, the alluvial deposit started accumulating in the Tethys geosyncline around 60 million years before the present when the Himalayas started rising.
  + The average depth of deposits is around 1000-2000 m made up of alluvial's as these are depositional plains.

### Physiographic Regions of India

* + Physiographic features are the external look of a body i.e. what does it look like. Hence, on the basis of what different regions of the country look like, it is divided physio graphically into 6 major regions -
    - Northern and North Eastern Mountains
    - Northern Plains
    - Peninsular Plateau
    - Indian desserts
    - Coastal plains
    - Islands

#### *Northern and North Eastern Mountains*

**General characteristics**-

* + West to the east length of around 2500 km.
  + Width ranges from 400 km in the west to 160 km in east.
  + On the basis of ranges, they are divided into 5 major ranges -
    - Trans-Himalayas
    - Greater Himalayas
    - Middle Himalayas
    - Outer Himalayas
    - The Purvanchal Range

**Trans Himalayas**

* + It comprises 4 mountain chains - the Karakoram, Ladakh, Zanskar, and Kailash
  + Collectively the Trans Himalayas are nearly 1000 km in length and the average heights of the peaks are around 3000 meters. And the width varies from 225 to 240 km.
  + The **Karakoram range** is known for some of the important glaciers such as the Siachen glacier, Baltura glacier, it also has the second-highest peak of the world, known as K2 or Godwin Austen. It is also known for the Karakoram Pass.
  + Ladakh Range and Zanskar Range (to be covered later)
  + Kailash mountain has the Kailash peak, at the foot of which is the Man Sarovar lake. It is in the Tibet region.

**Greater Himalaya**

* + The Greater Himalayas have average heights of 6100 meters, an average width of 25 km.
  + Greater Himalayas are also called Inner Himalayas, Central Himalayas, and also Himadri.
  + They extend from Nanga Parvat on the west to Namcha Barwa on the East. Because two of the antecedent rivers starting from near Man Sarovar lake go all the way up to Nanga Parvat (Indus river) and Namcha Barwa (Brahmaputra river) before crossing the Greater Himalayas, going around the nanga Parvat and Namcha Barwa making a sharp bend. These sharp bends are called Hairpin bends or **Syntaxial bends**. These rivers were not able to cut through the Greater Himalayas to make their own pass, hence go around it to cross.
  + The Greater Himalayas is made up of granite and gneiss rocks (new), hence they are solid rock mountains.
  + The southern slopes are steep and the northern slopes are gentle.
  + Many peaks are more than 8000 meters high. Mt. Everest nearly 9000 (8848) m. Mt. Everest other names - Quomolongma, Sagarmatha.
  + There are many passes of importance that are relatively low in height allowing the easy crossing of the Greater Himalayas. Such as the Burzil (J&K), Zojila (Ladakh), Baralacha la & Shipki la (Himachal Pradesh), Thaga la, Niti la, Lipu La (Uttarakhand), Nathu la & Jhelep la (Sikkim)

**Middle Himalayas**

* + Also known as Lesser Himalayas, Lower Himalayas, and also Himachal Himalayas.
  + Average height - 3500-4500 meters
  + Has gentle forested northern slope and steep and bare rock southern slope.
  + There are some peaks which are above 5000 m height which remains snow-covered round the year.
  + Ranges - Pir Panjal, Dhauladhar, Mussoorie, Nag Tibba, Mahabharat (in Nepal), Sikkim, Darjeeling, Miri, Abhor, Mishmi, Dafla, etc. in Arunachal Pradesh

**Outer Himalayas**

* + Also called as Shivalik Himalayas
  + Average height - 600-1500 m.
  + It extends only up to the Brahmaputra Valley in Assam where the outer Himalayas merge with the Middle Himalayas.
  + The valley between the Middle Himalaya and Outer Himalaya from Jammu and Kashmir up to Nepal is known as Doons/Duns. Whereas, when the Middle Himalayas merge with the Outer Himalayas and the duns will no more be there, then, it leads to the formation of the Duars/Dooars which are relatively gentle sloping on the south, which are found in the West Bengal, Sikkim, and Assam region.

**Purvanchal Range**

* + Includes (from N to S) Patkai Bum, Naga Hills, Manipur hills, Mizo, or Lusai hills.
  + Known for sandstones and slates.

#### *Classification of Northern and North Eastern mountains on the basis of region*

**Kashmir Himalayas**

* + It extends between Indus to Ravi rivers.
  + This region has all the ranges - from Trans to Outer Himalayas.
  + The region is known for glacial deposits of Moraine and clay which are locally called **Karewa deposits**which are very good for growing saffron.
  + It is also known for temperate mountainous grasslands called meadows (Merg in local language) which are used for **Transhumance (nomadic herding)**by tribes like Gujjars, Bakarwals, Gaddis, Bhotiyas etc. In winter they become good spot for winter sports like skiing.
  + Important **Passes**- Khardung La (Ladakh range), Photu La (Zanskar range), Banihal pass (Pir Panjal)
  + **Lakes -**Saltwater - Morari Tso, Pongan Tso, Freshwater - Dal, Wular, etc.

**Himachal & Uttaranchal Himalayas**

* + Extends from Ravi to Kali river
  + Kailash range (Trance Himalaya) and Greater, Middle, and Outer Himalayas found.
  + **Cold Semi-Arid region** - Lahaul, Spiti, and Kinnaur
  + Many hill stations developed during the British period in Himachal and Uttarakhand.
  + Duns - Dehradun, Chandigarh dun , Kalka dun, Nalagarh??
  + Many pilgrimage centres are also here.
  + Grasslands (mountainous, temperate) called **Bugyal** e.g. Auli Bugyal

**Darjeeling and Sikkim Himalayas**

* + Darjeeling and Sikkim Himalayas in their lower regions, known as Duars, which are gently sloping, low soil erosion, good water drainage as water does not accumulate, good rains around the year and for a longer period, and relatively milder winter - all of these conditions being favourable for tea plantation in the duars. Hence, plantation agriculture is well-practiced here, supporting a relatively large population.
  + It is also known for orchids, decorative/ornamental flowers, hence, good potential for Floriculture.

**Arunachal Himalayas**

* + Extends from the border of Bhutan to the eastern part of Arunachal Pradesh.
  + Outer Himalaya is not found.
  + Deep gorges by Brahmaputra (Dihang) are found. Hence, has high hydroelectric power potential.
  + Here different hills are occupied by different tribes after which the hills are named. From west to east - Monpa, Dafla, Abhor, Mishmi, Nyishi, Nagas. All practice Jhum cultivation.
  + The important passes - Bomdi la and Pangsu la

**Eastern Hills**

* + They have North to South orientation
  + In the Manipur Hills, there is Loktak lake, which is known for its floating vegetation. Hence, it is called a Kaibul Lamzao Floating National Park.

### Northern plains

* + They have a general length (West to east) of 3200 km and a width (north to south) of 150 (in the west) -300 (in the east) km
  + On the basis of deposits, these plains are divided into - Bhabar, Terai, Bangar, Khadar, and Deltaic.

**Bhabar region**

* + From Indus up to Tista river in Sikkim
  + Width - around 8-10 km.
  + Made up of rocks and pebbles, the river flows under the gaps of rocks, hence it disappears. Hence, not good for agriculture.

**Terai region**

* + Width - 10-20 km
  + Generally a sandy, silty region with good soil moisture.
  + The river reappears on the surface.
  + Earlier it was Marshy and swampy, hence, densely vegetative. When the vegetation was cleared and the region was used for rice cultivation.

* + **Characteristics of Bhangar region**
  + These are upland alluvial hence, there are no floods or very less floods.
  + Relatively coarser zone made of sand and coarser silt and the soil here contains Kankar which are calcium nodules.

**Khadar region**

* + They are low land alluvial hence more flood-prone. Hence, frequently get newer alluvial deposits and finer deposits.
  + It is good for the cultivation of sugarcane, rice, Jute etc.

**Deltaic region**

* + The delta region is the sub-part within Khadar, made up of generally the finest of the alluvial deposits. And hence, highly fertile supporting up to 3 crops of rice annually known as Aus, Aman, and Boro
  + Also known to form Oxbow lakes which are good for jute processing after cultivation.
  + They extend even in the Sunderban zone.

The above classification was based on the type of soil deposits. Another classification of these plains can be done on the basis of the region over which they are found.

### Classification based on the regions

* + Punjab Haryana Plain, Upper Ganga Plain, Middle Ganga Plain, Lower Ganga Plain, Brahmaputra Plain,

**Punjab Haryana Plain**

* + It extends from the plains of the Jhelum river on the North up to the western parts of the plains of Yamuna river on the southeast.
  + These plains include -
  + Alluvial deposits are brought mainly by the five rivers which are the tributaries of the Indus - Sutlej, Beas, Ravi, Chenab & Jhelum.
  + The whole Punjab region is made of lands between two rivers known as **Doab**.
  + Hence, Punjab means the land between five rivers. But the total land of Punjab is made of different doabs joining together.
  + Major doabs making Punjab region are -
    - Doab between Sutlej and Beas - called BIST Doab.
    - Doab between Beas and Ravi - called BARI Doab.
    - Doab between Ravi and Chenab - called RECHNA Doab
    - Doab between Chenab and Jhelum called CHAJ Doab
    - Doab between (Chenab & Jhelum) and Indus called Sindh Sagar Doab.
  + Along with 5 Doabs Punjab Haryana plains includes plains south of Sutlej and west of Yamuna, called **Malwa Plains.**
  + These rivers are flowing westwards, hence as we move towards the border of India (westward) the soil gets finer. Hence, near the Indian border, it is relatively more fertile.

**The Ganga Plains**

* + The Ganga Plains are the largest part of the Northern Plains. Starting from the north of Delhi going up to Kolkata, formed by deposits brought by Himalayan and peninsular tributaries of Ganga.
  + The Plains are relatively higher in the Northwest (near Delhi) and gently slope downwards towards Kolkata in the East.
  + In the south, they extend up to the beginning of the peninsular plateau.
  + The Ganga Plains are further divided into three subdivisions namely -

**Upper Ganga Plain -**

* + It lies between the Yamuna on the west and the Ghaghara river on the east.
  + This is generally a slightly steep slope plain, hence, water drains fast with a low probability of floods.
  + Upper parts are made up of Bangar deposits, whereas, lower parts are made up of Khadar deposits.
  + Culturally upper plains are called **Rohilkhand plain** and lower part **Awadh plains**.

**Middle Ganga Plain -**

* + It extends between the Ghaghara on the west to Kosi on the East.
  + It is a gentle sloping region made up of finer silt deposits because it is flooded frequently by rivers like Gandak and Kosi (aka sorrow of Bihar). But also relatively fertile land. The river Kosi keeps changing its course frequently.
  + The pain between Gandak and Kosi river is also called as **Mithila Plain**
  + Son is a major peninsular tributary of Ganga in Middle Ganga plain joining the Ganga as a right bank tributary. The plain formed east of Son is known as **Magadh Plain.**

**Lower Ganga Plain**

* + It extends from the east of the Kosi river,  goes up to the plains of Teesta, and goes up to the mouth of the river Ganga.
  + Extends from eastern Bihar to West Bengal as the lowest parts of the Ganga Plains.
  + On the North, they are marked by the Duars.
  + Nearly 2/3rd is made of delta known for swamps, oxbow lakes, mangroves (intertidal forest), and also some depositional islands e.g. New Moore Island, Ganga Sagar Island, etc.

**Brahmaputra Plain**

* + The Brahmaputra plains lie in the valley of the Brahmaputra river starting from Sadiya on the east up to Dhubri (where the Brahmaputra enters Bangladesh from India) on the west.
  + The Brahmaputra plains aka Brahmaputra valley/ Assam plain/valley.
  + The region has a gentler gradient and is more fertile from east to west.
  + Many tributaries join, we also see meandering, oxbow lakes, marshes and swamps, and depositional riverine islands such as **Majuli island** which is amongst the biggest riverine islands in the world.
  + These are very fertile plains hence supporting the largest population in the North East.

**Importance of northern plains**

* + The northern plains support a major part of the population, nearly half of the population of India, more than half of Pakistan, and the whole of Bangladesh population hence the most fertile and population supporting riverine plains in the world.
  + It is also one of the oldest, continuously inhabited regions of the world.
  + Supports agriculture, industry, transport, etc.

**Peninsular Plateau**

* + The peninsular plateau on the northwest is up to Aravalli, in North up to the plateaus of Malwa, Bundelkhand, Chota Nagpur, Rajmahal hills, etc., on the eastern side up to the Eastern ghats, on the western side up to the Western Ghats starting from Gir Girnar Hills in Kathiawar and going south up to Cardamom hills.
  + Hence, it is almost a triangular block lying in the geological peninsular block of India as the region south of Indian deserts and north Indian plains.
  + The peninsular plateau also includes the north-eastern plateau of Meghalaya and Karbi Anglong Plateaus which are separated from the main region by the delta of Ganga-Brahmaputra.

**General characteristics**

* + It is known for various Patland plateaus. Where Patland plateau simply means old dissected plateaus e.g. plateaus of Hazaribagh plateau, Palamu plateau, Chhotanagpur Plateau, Ranchi Plateau, Karnataka plateau, Coimbatore Plateau, etc.
  + This is the oldest and most stable landmass region of India having a general slope from west to east.

**Some of the other important features include -**

* + The **Tor regions** - big rocks are present
  + **Block mountains**
  + **Rift valleys**of Narmada, Tapi etc.
  + **Spurs**(slopes of the hills)
  + **Dykes**(natural water reservoirs - Tank reservoirs)
  + **Hammocky Hills**- granite and sandstone rich regions
  + **Basalt lava plateau**- over this peninsular plateau region which is nearly 550 m years old, basalt lava plateau is also found, which is around 65 m years old plateau region, deposited over the ancient peninsular plateau as the new basalt lava plateau. Aka Deccan lava plateau. Basalt lava plateau is mostly known for the **black soil region**of the peninsular plateau, which is useful for cotton cultivation. Hence, aka black cotton soil.
  + This region has also seen some upliftment and subsidence. Upliftment of the Western Ghats and Eastern coastal plains. Subsidence of the Western coastal plains. It has also led to the formation of rifts and blocks.
  + Old Gorges formed by rivers like Kaveri and Chambal are also found.
  + Ravines (Badland regions) e.g. Chambal badland
  + The peninsular plateau is further divided into three regions - The Central Highlands, Deccan Plateau, and NE Plateau.

**NE Plateau**

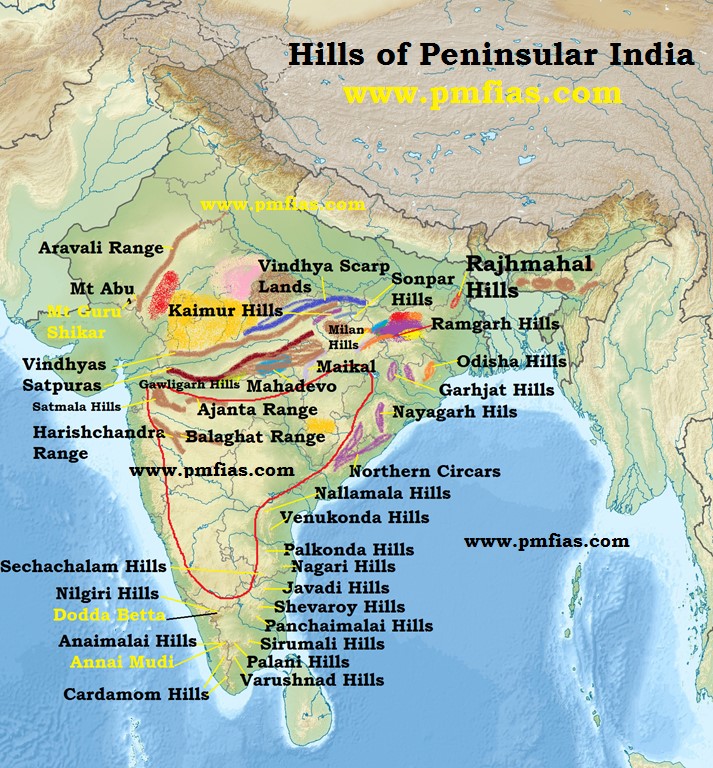
* + It comprises the **Meghalaya plateau** region in which we have three regions - Garo, Khasi, and Jaintia hills, and **Karbi Anglong Plateau** - Mikir Hills, Barail Mountain, Rengma hills, and Karbi Anglong hills.
  + Meghalaya plateau is separated from the Rajmahal hills and Hazaribagh plateau by the delta of Ganga-Brahmaputra known as the **Rajmahal-Garo Gap/fault or Malda fault.**Because of some probable faulting in geological past.
  + The NE plateaus is a mineral-rich region known for coal, iron ore, sillimanite, limestone, and uranium deposits.

**Central Highlands**

* + It extends from the Satpura Range in the south, which includes Mahadev hills and Maikal ranges to on the east the Rajmahal hills and Hazaribagh plateau, and on the west the Aravalli range.
  + North of this region it includes the Vindhyan range which extends from nearly Chittorgarh up to Kaimur hills, Bundelkhand, Baghelkhand, Chhotanagpur plateau, up to the Garhjat hill region.
  + Central Highlands is known for mineral resources such as limestone in the Vindhyas and precious stones. Chhotanagpur plateau is known as the Ruhr of India.
  + The general elevation is 700-1000 meters.

**Deccan Plateau**

* + **Western Ghats**
    - The Western Ghats starts from the south of Tapi and goes up to Kerala.
    - The highest peak in the north is Kalsubai.
    - Major pass from north includes Thal Ghat (near Kalsubai, through which Mumbai-Nasik-Agra railways and national highways goes)
    - Near Mahabaleshwar, there is Bhor Ghat. Mahabaleshwar in recent years has become one of the highest rainfall receiving regions. Through Bhor Ghat Mumbai-Pune connectivity exists.
    - As per the NCERT, the Sahyadri extends from Maharashtra to Goa and this part is called Sahyadri.
    - Baba Budan Hills in Karnataka.
    - In the south, there is Nilgiri peak, here at hill station Ooty or Udgamangalam.
    - Nilgiri is where the Western and Eastern Ghats meet.
    - The highest peak of Nilgiri is **Doda Betta** (second highest in South India).
    - South of Nilgiri is the Anaimalai hills in which the highest peak south of the Himalayas is **Anaimudi**.
    - The pass between Nilgiri and Anaimalai - Palghat (aka Pala Kkad).
    - South of Anaimalai there is Cardamom hill (here the Western Ghats ends).
    - South of Cardamom hills is another pass called **Shenkotta gap**.

* + **Eastern Ghats**
    - South of Anaimalai, there is **Palani hill**. Where there is Kodaikanal (hill station).
    - South of Palani hills is Varushnag hill.
    - On the eastern side, there is Sirumalai hill followed by Panchmala hill which is south of Shevaroy hills.
    - Moving to the north of Shevaroy, we have Javadi hills, Palkonda range, Nagari Hills, Sheshachalam Hills (a region known for red sandalwood), Velikonda Hills, Nallamalai hills, Erramala hills, Cuddappah hills.
    - The Eastern Ghats further continues in Odisha but it is highly dissected by numerous rivers and tributaries. Some of the important peaks in the Eastern Ghats are Mahendra Giri near Chilika lake, Niyamgiri peak (rich in bauxite, Dongrila Khond tribes are natives here),
    - Other parts include - the Telangana plateau, Harishchandra Range, Balaghat Range, Satmala Hills, Ajanta Range, Gavilgarh Hills.
    - 

* + **Some additional characteristics of the Deccan Plateau**
    - The western ghats are the higher parts of the region with an average height of 1500 m.
    - Most of the major peninsular rivers originate from the western ghats except for Narmada, Tapi, and Mahanadi.
    - Also, many of the west-flowing rivers going to the Arabian Sea start from Western Ghat.
    - Western ghats are also relatively more continuous having only 4 major passes as ghats.
    - Height in the western ghats increases from north to south.
    - Eastern ghats are relatively more discontinuous.
    - The average height is lower, around 600 m.
    - There are other plateaus such as the Telangana Plateau, Basalt lava plateau which are part of the Peninsular plateau.

**Rajasthan Desert**

* + Aka the Thar desert.
  + It is a sandy desert region that in its northern part slopes westward and in the southern part slopes southwards.
  + Geologically it is part of the peninsular block as the bottom rocks below the sand are of the peninsular block.
  + Known for its various erosional and depositional landforms like sand dunes etc.

**Coastal Plains**

* + Coastal Plains of India are further divided into Western Coastal Plains and Eastern Coastal Plains.

**Western Coastal Plains**

* + The Western Coastal Plains are further subdivided into -
    - The Coastal plain of Kachchh
    - The coastal plain of Kathiawar
    - The Coastal plain of Konkan (subdivision - Goan coastal plain)
    - The Coastal plain of Malabar (From Karnataka to Tamil Nadu)
  + Subdivisions - Karnataka (Kannada) coastal plain and Kerala coastal plain
  + Western Coastal Plains are narrow in the middle and wider in the north and south.
  + The whole Western Coastal Plains is the **coast of submergence**, hence, has many **natural harbors** for the development of shipping-related activities. Hence, on this coast, we have many major ports and natural harbors such as Cochin port, JNPT, Kandla, etc.
  + On the Gujarat coast, the ancient submerged city of Dwarka is found.
  + Many **lagoon lakes** are found along the Malabar Coast. Lakes have a minor opening towards the ocean hence ocean water will also mix. The local word is **Kayals** e.g. Ashtamudi Kayal, Vembanad Kayal (Punnamada Kayal is within it, where snake boat race takes place).

**Eastern Coastal Plains**

* + It is a **coast of emergence**.
  + The Tamil Nadu and Andhra coasts are called the **Coromandal Coast**.
  + The northern part region from northern Andhra Pradesh up to Odisha is called **Northern Circars**.
  + Eastern Coastal Plains are relatively broader mainly due to the delays of big rivers in this region. Hence, very fertile grounds supporting large populations such as in the Vegai region, Kaveri, Krishna, Godavari, Mahanadi deltas, etc.

**Island Regions**

* + They are further divided into three groups -
    - Arabian Sea Islands, Coastal (Continental shelf) Islands, Bay of Bengal Islands
  + **Bay of Bengal Islands**
  + Mainly in the BoB, there are around 572 all of which are collectively part of the Andaman Nicobar group of islands.
  + The Andaman & Nicobar Islands are separated from each other by a 10 deg channel. 10 deg is the latitude line and the channel is the deep passage through which large ships can cross from one side to the other.
  + In the Andaman Nicobar, the highest peak is the Saddle peak.
  + The Landfall island Is the westernmost island of the region and Indira Point is the southernmost point.
  + These are volcanically formed islands. These are not coral islands.

**Lakshadweep Islands**

* + Lakshadweep islands comprise around 36 major islands where the Minicoy island is the largest, separated by a **9 deg channel** from the Cannanore Islands. Cannanore islands are separated by **11 deg channel** from Amindivi Islands.
    - Cannanore islands have two major islands - Agatti and Kavaratti.
  + Eight Degree Channel separates the islands of Minicoy and Maldives
  + They have been named so as they lie on the eight, nine and ten-degree line of latitude, north of the equator.

**Coastal Islands**

* + The third group of islands is the ones that are near the coast and geologically part of the continental shelf starting from West Bengal up to Gujarat.
  + West Bengal - New Moore and Ganga Sagar Islands - at the mouth of Ganga
  + Wheeler Island (now Abdul Kalam Island) - at the mouth of Mahanadi
  + At the mouth of Chilika river - Parikud island
  + Mouth of Pulicate lake - Shri HariKota Island
  + In the Gulf of Munnar region - The Crocodile Island, Pamban Island, and many islands by the name of Tivu e.g. Kachhativu
  + Cochin - Vypin island, Wellington island
  + Mangalore coast - St Mary island, Bhatkal island, etc.
  + Goa - Angidiv island etc.
  + Mumbai coast - Butchers island, Elephanta, Salsette island, etc.
  + The mouth of Narmada and Tapi river - Khadirbet island, Aliabet island.
  + Diu island at the southern tip of Kathiawad.

## The drainage system in India

* + **Total water on Earth**
    - 96.5% of water is ocean water.
    - 0.9% other (than the ocean) saline water.
    - 2.5% - freshwater.

**Distribution of Freshwater**

* + 69% - in form of glaciers and icecaps.
  + 30% - in form of groundwater
  + 1.2% - in form of surface & other freshwater

**Distribution of surface & other freshwater**

* + 69% - in form of ground ice & permafrost.
  + 21% - in lakes
  + 3.8% in soil moisture.
  + 3% in the atmosphere.
  + 2.6% in swamps and marshes
  + 0.5% in rivers
  + 0.26% in living organisms

* + **Water availability in India**
  + In India, all the water available is approximately 4% of the global freshwater.
  + How much water we receive each year = national avg annual rainfall x total area of country = 125 cm/yr X 3.28 ms km = ~4000 cubic km.
  + Out of this 1850 cubic km is the annual potential flow in rivers and streams.
  + Out of this only ~1100 cubic km is utilizable, in the form of nearly 700 cubic km from the surface water and the remaining 400 cubic km in groundwater.

**Annual Demand of water in India**

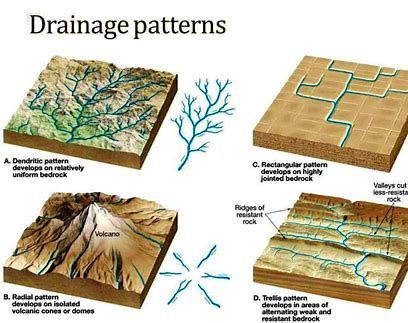
* + In 2000 - 650 cubic km
  + In 2025 - 1100 cubic km (which will be equal to the utilizable water)

**Per capita Demand**

* + As per the international norms (UN), a country is called **water-stressed** if it gets less than 1700 cubic m of water annually per person. If it gets less than 1000 cubic meters per person annually, it is called a **water-scarce** country.
  + India
  + In 1951 - we had 5200 cubic m per person availability of water (not utilized)
  + In 1991 - it came down to 2300 cubic m per person.
  + In 2001 - 1900 cubic m per person.
  + In 2010 - 1600 cubic m per person.
  + In 2025 (expected) - 1400 cubic m per person
  + In 2050 (expected) - 1200 cubic m per person.
  + Hence, on the basis of annual average availability country is already in water-stressed and is gradually moving towards water-scarce.
  + But India does not get a uniform amount of water round the year. The rainfall variation is from 15 cm in Rajasthan to 1100 cm annually in Khasi hills. Also, even this rainfall does not happen uniformly throughout the year. Nearly 75% of the rains happen in the summer monsoon month and the remaining 25% in the remaining 9 months. The dries places get only 5 rainy days in a year. Whereas some places get as many as 150 rainy days a year.
  + Rainwater - utilizable part - Groundwater; Surface water - lakes/other wetlands and rivers/streams.
  + The rivers/streams generally drain the water of their catchment area (the area which goes into the river/stream) and carry this water to the oceans or the wetlands or the lakes. Hence, simply said drain the country or land. And hence, the system of the rivers is known as the Drainage system of a region.

**The different terms related to drainage system are as given below**

* + **Channel** - it is the long natural depression in the ground in which the water is flowing. Channel might have different sizes. In increasing size - Rills < Gulleys < Streams < Rivulets < tributary rivers < Main rivers.
  + **Drainage -**the flow of water through a well-defined channel is called drainage.
  + **Drainage system -**The network of channels is known as the drainage system.

* + **Drainage pattern -**Drainage systems generally have different shapes depending on the kind of region over which they are created, known as drainage patterns.
    - The simplest drainage pattern is the one looking like the branches of a tree, known as the **Dendritic pattern** (means tree-like) starting from hilly areas.
    - There are other patterns, such as **rectangular pattern** formed over fractured or faulted land.
    - **Radial pattern** where from the top of the hill different channels go in a different direction like the Amarkantak hill in the Maikal Range where Son, Narmada and a tributary of Mahanadi go in different directions, north, west and east.
    - **Trellis pattern** - this happens in parallel mountain valleys.
    - **Parallel pattern -**tributaries flow parallel to the main river.
    - 

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    Exp) Option b is the correct answer. 
    Drainage pattern is the pattern formed by the streams, rivers, and lakes in a particular drainage basin. 
    They are governed by the topography of the land, whether a particular region is dominated by hard or 
    soft rocks, and the gradient of the land. 
    Pair 1 is correct: Dendritic pattern is also known as pinnate drainage and looks like branching of a tree. 
    These are mainly found in regions with homogenous materials and develop where rock beneath the 
    stream has no particular structure. This helps in easy and equal erosion in all directions. frruly dendritic 
    systems form in V-shaped valleys. 
    Pair 2 is correct: Trellis drainage system is generally formed where sedimentary rocks have beep 
    folded or tilted and then eroded to varying degrees. The short subsequent streams meet the main 
    stream at right angles. Through soft rocks differential erosion paves the way for tributaries. 
    Pair 3 is incorrect: In radial drainage system, the streams radiate outwards from a central high point. 
    For example, rivers originating from Amarkantak range forms radial system. In centripetal drainage 
    system, rivers discharge their waters from all directions into a lake or depression. The centripetal 
    drainage system is similar to the radial drainage system, with the only exception that radial drainage 
    flows out versus centripetal drainage flows in. 
  + **Catchment area -**it is all the surface region, the water of which flows, due to slope, finally into one channel.
  + **Basin (Drainage basin) -**Catchment of big rivers is referred as basin of the river e.g. Ganga basin. Basin, Drainage basin or river basin mean the same.
  + **Watershed -**catchment of small rivers or rivulets is referred as watershed of the river.
  + **Water Divide -**the high regions which separate one catchment from another is known as water divide. So that water on two sides of water divide flows in different directions and in different channels/catchments e.g. all the peaks of the parallel mountain range act as water divide. And few times (rarely) water divides are also called as **watersheds**. This is the second, very different meaning of watershed.
  + **River Regime -**the word river regime means the availability of water in the river round the year. Hence, which have similar amount of water round the year are said to have uniform river regime. Whereas, rivers having high amount of water in one part of year and very less/no water in another part of the year, are said to have a non-uniform river regime. Normally, rivers having glacial origin have uniform river regime whereas, non-glacial rivers have non-uniform river regime such as mostly peninsular rivers with the exception of Kaveri which has a uniform regime because its catchment areas get water from both summer monsoon as well as winter monsoon.

* + **National Water Divide**
  + The country has national water divides the water along highest points along the western ghats and hills of central India like Satpura, Vindhya's etc., then Aravalli's.
  + Significance of this line - All the water in the west of this line goes westward, and all the water east of this line goes eastward.

### The classification of the Drainage system in India

* + **On the basis of the size of catchment area -**
    - Major river basins (catchment area more than 20000 sq. km) - 14 such river basins. They account for 85% of all the water drained.
    - Medium river basins (catchment area - 2000-20000 sq. km) - 44 such river basins. 7% of the total river run-off of India.
    - Minor river basins (catchment area less than 2000 sq. km) - numerous such basins. 8% of the total river run-off of India.

* + **On the basis of Origin**
    - Himalayan - Ganga, Brahmaputra, Indus etc.
    - Peninsular - Kaveri, Godavari, Chambal etc.

* + **On basis of where the river drains**
    - Arabian Sea - Narmada, Tapi, Indus etc.
    - Bay of Bengal - Ganga, Brahmaputra, Godavari, Kaveri etc.
    - Inland Drainage - Luni, Ghaggar, etc.

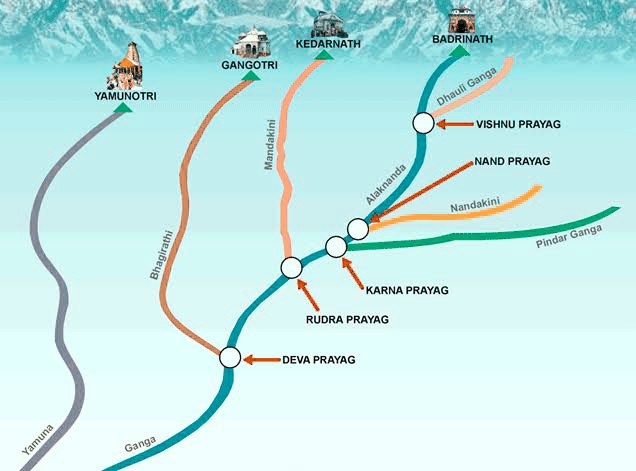
#### *Indus River*

* + AFGHANISTAN 
    РАЮ5ТАГЧ 
    CHlNA 
    4- 
    Т!ВЕТ 
    CHINA 
  + **Tributaries** - Zaskar, Leh, Kharche, Dras, Shyok, Nubra, Shigar, Gilgit, Humza, Kabul river, Kurram, Tochi, Gomal, Sangar, Viboa.
  + **Other important tributaries -**
  + **Jhelum** - starts as Sindh and Liddar, lakes like Wular and Dal. Its tributaries are - Kishanganga & Punch rivers.
  + **Chenab** - starts as Chandra (from Chandrataal in Spiti region) and Bhaga, when both meet it is called Chandrabhaga, after reaching Jammu it is known as Chenab. Tributaries - Jhelum, Ravi
  + **Ravi** - starts from Kullu hills, ends as a tributary of Chenab.
  + **Beas** - starts from Beas Kund near Manali in Rohtang
  + **Sutlej** - starts near Mansarovar in Rakas lake, crosses Greater Himalaya at Shipki La, meets its tributary Spiti river in India. It is known by the name of Langchen Khamban in Tibet. (Indus is known as Singi Khamban). It meets Beas at Harike Barrage (feeds water to Indira Gandhi Canal).
  + **Panchnad** - when Sutlej meets Chenab it is referred to as the Panchnad river which ultimately merges with Indus.

#### *Ganga & Brahmaputra River*

* + The Ganga river Starts from Uttarakhand.
  + There is Farakka Barrage where the water is divided - one part goes to Bangladesh and one part (Hugli river) to West Bengal.
  + Hugli river at the mouth is known as Bhagirathi.
  + In Bangladesh, Ganga is known as the Padma river.
  + Brahmaputra river starts in Tibet. It has different names - Tsang Po in Tibet, Yarlang Zangbo in China, Dihang in Arunachal, Brahmaputra in Assam, Yamuna/Jamuna in Bangladesh. After meeting the Padma in Bangladesh, the name becomes the Padma. When Meghna (Barak in India) joins the Padma, then the name becomes Meghna.

* + **Ganga at its origin**
  + Ganga originates as Bhagirathi river from Gangotri.
  + Another river Alaknanda, originating from Badrinath when meets with Bhagirathi at Dev Prayag, it is called Ganga.

* + **Tributaries of Alaknanda**
  + Mandakini, which starts from Kedarnath, is tributary of Alaknanda (meets at Rudra Prayag)
  + Pindar Ganga meets Alaknanda at Karna Prayag.
  + Nandakini meets Alaknanda at Nand Prayag.
  + Dhauli Ganga meets Alaknanda at Vishnu Prayag.
    - 

**Kaveri River**

* + Kaveri starts from Brhamgiri hills in Karnataka.
  + Tributaries - Hemavati, Lakshman Tirtha, Kabani, Swarnavati, Shimsa, Arkavati, Bhawani river (the first multipurpose project of independent India in South India), Noyal, Amravati.

**Interlinking of Rivers**

* + Interlinking of rivers in India has been done for centuries especially in Peninsular India e.g. Buckingham Canal, Periyar diversion scheme, etc.
  + Later on other studies were done on interlinking and creating a **National Water Grid** for transferring water from surplus region to deficit region. The idea was given by **Dr. K L Rao**.
  + In 1980, the inter-basin water transfer plan known as National Perspective Plan was developed, having two components - the peninsular river development component with 16 Canal Interlinking projects and the Himalayan River Development component having 14 Canal Interlinking Projects. **National Water Development Agency** was set up in 1982.
  + The idea was to increase the total irrigated area for agriculture and also produce hydroelectric power along with inland water transport of commercial goods, flood control, etc.
  + Various studies and plans for these projects have been made in the past. But there are various challenges also identified such as environmental concerns, interstate water sharing, the high cost of projects, and accurate understanding of the idea of excess water especially due to climate change and global warming.
  + Working forwards towards these projects, different states of India have submitted 47 Intra-state link proposals to the Union govt for fulfilling the River Interlinking projects.
  + The development on this front has been slow.

#### *Irrigation in India*

* + To supply water to the soil so that soil has needed moisture to support required vegetation and crop with respect to agriculture.
  + **Moisture available in Soil for agriculture**

Sources - rainfed, irrigated.

**Rainfed**

* + It can be divided into wetland regions and dryland regions (less than 75 cm rainfall annually).
  + In the wetland, soil moisture is as needed or more.
  + In dryland regions, soil moisture is much less than needed.

**Types of Irrigation -**

* + **Protective Irrigation** - providing just the required soil moisture so that the crop does not die.
  + **Productive Irrigation**- it is done to maximize agricultural produce by giving more moisture to the crop so that it does not just grow but grows to the maximum. This can be in any region - dryland/wetland.
  + It is done mostly in commercial agriculture.
  + In India, nearly 49-50% of the total area under agriculture is irrigated. (Nearly half of India’s total area is under agriculture and nearly half of the area under agriculture is irrigated).

**Methods of irrigation**

* + **Macro Irrigation**
    - Based on the source of water
    - Traditionally it has been applied as **Flood Irrigation** (a very inefficient method as most water evaporates as India is a tropical country).
  + **Types of Macro irrigation**
    - Nearly 46% region is tube well (electrical) irrigated
    - 17% region is well irrigated
    - 24% is canal irrigated.
    - 3% is Tank irrigated (in peninsular India)
    - 8% - other sources

* + **Micro Irrigation**
    - Scientific, closed pipe/channel irrigation, focussing on soil moisture.
    - More efficient irrigation.

* + **Types -**
    - Drip Irrigation
    - Sprinkler Irrigation
    - Fertigation

### Soil

* + For any region, we generally use the term land but the term soil is used for the ability to support the vegetation. The vegetation might grow naturally as in forest for by the human beings as in agriculture.

**Role of soil -**

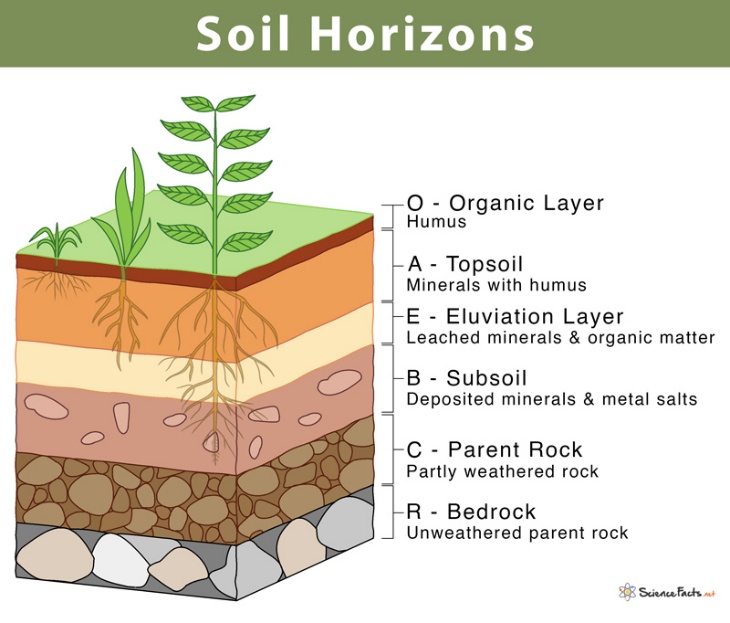
* + Providing support to the plants
  + Providing moisture to the plant
  + Providing aeration to the plants
  + providing nutrients to the plant

* + **Moisture** - sandy (coarser) soil has less moisture and clayey soil (finer) has more moisture.
  + **Air** - sandy soil has more air, clayey soil has less air.
  + **Mineral nutrients -**
    - **Macronutrients** (6) - Primary - N, P, K; Secondary - Ca, Mg, S
    - **Micronutrients** (8) - B, Cu, Cl. Fe. Mn, Mo, Zn, Ni
  + These can be provided through Abiotic and Biotic sources.
  + Abiotic sources - rock minerals.
  + Biotic sources - partially decayed matter/ simple organic matter called **Humus**. It is formed by microbial partial decaying of dead plants and animal material plus plant/animal waste material.

**Layers of soil**

* + **OAEBCR (ओ आज एक बार C राजा मोहन हो बुलाओ)**
  + **O Horizon -**dominated by organic matter, leaf, and stem litter. Present in dense forests and in isolated patches elsewhere.
  + A Horizon - zone of accumulation of organic matter and inorganic nutrients.
  + B Horizon - zone of illuviation (accumulation of clays). it is also the subsoil region.
  + C Horizon - Parent material - weathered rocks.
  + R Horizon - Bigger parent rocks.

* + The main soil is the A horizon where the plants are rooted. And it should be a good mix of inorganic rock minerals and organic humus.

* + 

**Movements of minerals in the soil, different processes**

* + **Translocation -**Minerals move vertically in soil downward or upward

* + **Downward movements**
    - **Eluviation -**removal from the upper horizon by moving downwards.
    - **Illuviation -** reaching the lower horizons coming from the upper horizon.
    - Examples -
      * **Decalcification** - it is calcium leaching, which happens in moist conditions where calcium gets dissolved in soil water and percolates downwards.
      * **Desilication** - silica gets removed from topsoil and goes to lower horizons whereas aluminium and iron remain in the top layers, making oxides. This happens in drier conditions such as the red soil region.
      * **Podzolization -** opposite of desilication. Happens in coniferous or temperate climate soil regions, making soil silica-rich and acidic (iron goes down, silica comes above).

* + **Upward Movements**
    - It is mainly due to **capillary action** where topsoil dries and groundwater rises by capillary action bringing dissolved minerals from lower horizons to the topsoil. As groundwater evaporates on topsoil, the dissolved minerals are left behind on or just below the topsoil.
    - Examples -
      * **Calcification** - calcium will rise up to just below the topsoil.
      * **Salinization**- sodium and potassium salts rise up to topsoil making a hard white salt layer over the topsoil. Salinization makes soil infertile. Salinization also happens due to excessive tubewell/well irrigation in hot drier regions e.g. Punjab, Haryana, W Uttar Pradesh, etc.
      * **Waterlogging or Gleying** - happens when groundwater level rises excessively making the topsoil marshy or swampy regions e.g. Terai region, deltas of rivers.

* + **Factors affecting soil development**
  + **Parent Rock Material**
    - Example -
      * Basalt lava plateau - black soil region.
      * Metallic mineral-rich older peninsular plateau - Red soil region.
      * Mixed weathered & deposited rock minerals of Himalayas - alluvial soil (northern plains & coastal plains)
  + **Slope (relief)**
    - High slope - more erosion, less deposition -> thin soil
    - Low slope - more deposition -> thicker soil.
  + **Natural Vegetation**
    - Rich vegetation -> humus-rich soil e.g. mountain and forest soils.
    - Poor vegetation -> sandy soil, low/no humus e.g. arid or desert soils.

* + **Millets** 
    - Jowar, Bajra, ragi
    - Very less water, less fertile soil and warm and arid regions.
    - Climate smart grain - food security
    - Fibre, Protein and vitamins rich
    - Impact on India -
      * Crop diversification
      * Suitable climate to grow

**Factors affecting soil formation:**

* + **Role of Climate:**
    - along with parent rock plays an important role as climate along can develop different types of soil from similar rocks
    - on the other hand, climate can also lead to the formation of soil from different rocks
    - Example:
      * in Hot arid regions climate can cause both granites which are also igneous rock and sandstone/slate to give sandy soil which is arid soil
      * from metallic mineral-rich peninsular plateau rocks in dry climate leading to red soil whereas alternate wet and dry climate as in parts of Orissa, Andhra, Meghalaya, Coastal Maharashtra, Karnataka, Kerala, TN
      * where there is a distinct wet monsoon season with other seasons remaining dry we get lateritic soil

**Types  of Soil**

* + In India, soils  are classified in 2 types since ancient times
    - Urvara (fertile)
    - Utara
  + In recent times based on formation, colour, and characteristics the major soil types in India can be-
    - Alluvial
    - Black
    - Red and yellow
    - Laterite
    - Arid
    - Forest and mountain
    - Peaty
    - Saline

**1)Forest and mountain soils**

* + Found in the Himalayas as in J&K, Himachal, UK, Sikkim, Arunachal
  + Also found in some of higher mountainous regions in Western ghats like Karnataka, TN, Kerala
  + Generally have high rainfall
  + Mostly Soils are thin here
  + They account for nearly 8.5% of the area of the country
  + Have high humous and are used for cultivating fruit trees in J&K, Himachal, UK, Sikkim with some wheat, maize, and barley
  + In southern states plantations of tea, coffee, spices, and some tropical fruits are grown

**2)Alluvial soil**

* + these soil covers around 45% area of the country
  + which includes northern plains starting from Punjab west Bengal and also Assam plains
  + we also find soils in Sabarmati and Mahi river regions in Gujarat in eastern coastal plains which are wider coastal plains and some western coastal plains
  + they are depositional plains of rivers having sufficient potash but need nitrogen
  + on basis of texture it's divided into-
    - Bhangar
    - Khadar
  + Supports different crops such as jute, rice, sugarcane in wetter parts like WB, Eastern, UP, Bihar also Tarai regions from the UK to Bihar
  + In coarser drier regions it supports wheat, cotton, tobacco, maize, oilseeds, vegetables in other regions

**3)Black soil**

* + Called Regur soil or black cotton soil
  + found in Deccan lava plateau region and parts of Kathiawar, Maharashtra, Andhra and Gujarat and some parts of Madhya Pradesh.
  + 16.6 % of the area of the country
  + Well developed deep soil
  + Generally clayey hence holds waters and moisture
  + Good for the cultivation of cotton because of moisture retention
  + Sugarcane  and rice are also cultivated
  + Tends to shrink on drying developing cracks in the soil
  + This way upper soil falls in the crack and lower soil gets exposed causing natural soil mixing which is good for crops
  + Manually soil mixing is done by ploughing, here it's done naturally hence called as self ploughing soil
  + Lacks in organic matter
  + This is also very fertile soil used for cultivating a range of crops in wetter, drier, irrigated parts with crops ranging from rice, sugarcane, wheat, jowar, and other millets, different oil seeds, tobacco, legumes

**4) Red soils**

* + Contains an oxide of iron which gives its reddish colour
  + Covers whole peninsular plateau leaving black soil region and lateritic regions
  + Requires relatively dry climate for rusting and oxide formation
  + But in the lower part of plateaus especially in the valley which has moisture, the red soil develops into yellowish soil, relatively more fertile
  + Found in parts of Orissa, Chhattisgarh, Andhra, and Telangana, southern and south-eastern UP, Meghalaya, Manipur, and other southern states of TN, Karnataka, coastal regions of  Maharashtra,
  + less fertile than alluvial
  + lacks nitrogen, phosphates, and humous
  + mostly used for relatively medium quality crops when supported with irrigation and fertilizer
  + crops that easily grow-
    - Rice, cotton, wheat, millets, oilseeds, pulses

**5)Laterite Soil**

* + grows in the peninsula plateau region which has a distinct monsoon season due to which soil gets wet and after monsoon soil dries and harden due to hot and dry season
  + this process is similar to the brick formation and which soil is first wetted then heat dried
  + peninsular plateau soil is suitable for this type of brick formation hence called laterite which is a Latin word meaning brick
  + less fertile regions-
    - Orissa, Andhra, Tamil Nadu, western coast as also around Madhya Pradesh
  + when supported with irrigation and fertilizers
  + when supported with irrigation it provides some plantation crops, tea, coffee, rubber, Beatle nut, as well as coarse grains, fruits, vegetables, some rice, paddy, and animal feed
  + covers around 7.5% area of the country

**6)Arid Soil**

* + found in Rajasthan and Gujarat and also in the drier region of Telangana
  + this is relatively sandy coarser soil and if supported as in the Indira Gandhi canal region of Rajasthan it can support some drought-resistant crops like barley, millets, pulses, spices, oilseeds, chilly plants

**7)Saline soil**

* + Infertile soil
  + Found mostly due to salinization
  + hence excessive irrigation regions such as Punjab, Haryana, Western up, coastal regions of Maharashtra find these soil
  + salinity can be reduced by adding gypsum
  + most saline soils are difficult to reclaim

**8)Peaty soil/Marshy Soil**

* + Find in Terai region, deltaic region, Canals
  + Such waterlogged soils if reclaimed are used for rice, jute, sugarcane cultivation

**Cropping seasons in India**



|  |  |  |  |
| --- | --- | --- | --- |
| Seasons | Hot(monsoon)  kharif  June-September) | dry(oct-march)  Rabi | Dry (Apr-June)  Zaid  Hot, Short |
| North | Rice, Cotton  Bajra, Maize,  Jowar | cold  wheat, oilseeds  Barley | Vegetable  fruits  fodder |
| South | Rice, Maize, Ragi,  Groundnut, | warm/hot  rice, maize  ragi  groundnut | vegetables |

### Types of Agriculture in India

* + Forest-dwelling
  + Agriculture-
    - 1..Simple subsistence/jhum
    - 2. Intensive subsistence
    - 3.Nomadic herding-plains, Transhumance
    - 4. plantation agriculture
    - 5. the Mediterranean
    - 6. commercial grain farming
    - 7.Commercial animal rearing
    - mixed commercial farming

#### *Evolution of Agriculture in India*

* + **Phases and their effect-**
  + **1)From Ancient times till the arrival of European colonizers 1757-**
    - Forest dwelling, simple and intensive, subsistence agriculture and nomadic herding was practiced
    - in areas of Indus, Ganga, Brahmaputra, major river valleys
    - it was able to produce enough food and Agri products for villages and urban areas
    - farmers were self-sufficient
    - Villages were self-dependent
    - Agri produced trading played a major role in India's international trade

* + **2)European colonization 1757 till independence 1947-**
    - They wanted cotton fabric, spices, silk fabric
    - They wanted maximum revenue
    - Forced farmers to produce more and sell cheap to them
    - To extract maximum revenue from farmers, they gave more powers to middlemen
    - Middlemen were agents of colonial govt
    - Food shortages started happening, low profits hence poverty among the artisans
    - Rural poverty and food insecurity
    - Commercial crops were grown which benefitted the Colonisers, not  farmers
    - They forced growing other crops like indigo so farmers were not gaining
    - Investment in agriculture became low
    - Productivity became low
    - Therefore more Rural poverty
  + **In 1770s -->Industrial revolution**
    - for which they only needed raw material for the factories set up
    - they suppressed the Indian cottage industry and took all raw material
    - they made India market of the buyer of finished products
    - Rural Artisans became jobless-->unskilled landless laborers in rural and urban areas
    - cottage industry got fully suppressed
    - rural and urban poverty
    - outcome-
      * by 1947 India was suffering through a large recurrent food shortage
      * numerous famines
      * rural, urban poverty
      * led to hidden unemployment
      * net textiles importer from self-sufficient
      * creation of rich middlemen like zamindars in rural areas

* + **3)Post-independence to Green Revolution 1963-64**
  + **Challenges-**
    - Middlemen in rural areas->
      * Exploiting farmers
      * High taxes
    - More focus on cash and commercial crops
    - Hidden unemployment
    - Less investment in agriculture
    - High population pressure
    - low Agri productivity
    - Low total production
    - Monsoon dependence because of low irrigation facilities
    - Small farm size
    - traditional crops
    - these were identified by the new govt and they divided into two sets of challenges:
      * 1)institutional challenges
      * 2)investment-oriented challenges

* + **What govt did?**
    - Abolition of middlemen
    - Tenancy reforms
    - Land to farmers
    - land consolidation
    - land ceiling reforms
  + Status in the 1960s-
    - Though Zamindari was abolished as zamindars were no longer allowed to tax yet they remained in control of land ownership by teaming with state govts
    - Tenancy reforms didn't succeed much as formal rents were not fixed in govt records
    - land didn't go to farmers so no major change in land ownership from the British period
    - so not much profit to farmers or landless
    - land consolidation could not succeed due to poor land records
    - land ceiling failed mostly due to corruption
    - farmer profit didn't increase therefore not much increase in productivity and production for farmers
  + that's why focus shifted to the secondary sector in the next five-year plan
  + hence even by the 1960s problem of rural poverty, food shortage, and hidden unemployment continued
  + to overcome food shortage govt was forced to import food grains paid in foreign currency
  + food import was challenging mostly done under the upper hand of food supplying countries like PL-480 which was not conducive for India especially wrt sovereign foreign policy
  + so leaders decided to focus on ensuring food security indigenously within the country by increasing agricultural productivity and overall production and reducing rural poverty

**4)Green revolution till present 1963-64**

* + Challenges before the beginning of Green Revolution-
    - food insecurity, low productivity, and production, small fragmented land holdings
    - traditional variety of seeds which was though resistant to climatic variations but we were  not having high productivity in terms of volume hence total production was low
    - irrigation facilities were not developed
    - traditional variety of fertilizers were used which didn't improve the soil fertility in the short run
    - not much use of machines
    - not much productions no storage facility
    - not many Agri markets
    - lack of investment
    - lack of capital
    - agriculture done before was low on output
  + hence in this background Green revolution was launched
  + it was though technologically driven, but it included a range of other services by govt
  + hence not only the introduction of a high yielding variety of seeds but also a lot of support system to finally get usable desirable output
  + hence all technological support was input, output was high productivity, and high output
  + it was govt willingness to introduce the GR
  + In the 1940s HYV of wheat was already developed in the west and in 1951 they were introduced in Mexico
  + By 1956 Mexico was food self-sufficient
  + But till now govt was not intending to use this solution
  + It was only in 1963 on govt's willingness to find solutions, Dr. Norman Borlaug introduced HYV seeds to Dr. Swaminathan
  + 1964-65 drought year HYV wheat was field-tested in India

**Regions of Green Revolution-**

* + GR was introduced in different regions by providing needed support and to bring out the suitable region
  + For Ex: HYV wheat was available which was suited to Punjab, Haryana, Western UP
  + This region also had access to the canal irrigation
  + Farmers were ready to experiment with new crops
  + Later on HYV rice came from Manila, they were introduced in the Krishna Godavari region of AP, TN, Karnataka
  + traditional rice-growing areas didn't get initial HYV seeds as irrigation facilities were not there
  + Agri productivity increased
  + Output-
    - Much-decreased food import
    - Prosperity of farmers
    - New employment generation
    - Growth of industrialization of various products
    - Consumer goods production
    - created educated Agri classes

#### *Agricultural productivity*

* + **Present productivity of different crops in kg/Hectare**
  + **Paddy**
    - India - max productivity - 4000kg/H (Punjab), avg productivity - 2400 kg/H (India), min productivity - 1500 kg/h (MP)
    - World - max productivity - 6700 kg/h (China)
  + **Wheat**
    - India - max productivity - 5000 (Punjab), avg productivity - 3200, min productivity - 500 (Andhra Pradesh)
    - World - max productivity - 7400 (UK)
  + **Maize**
    - India - max productivity - 5400 (Tamil Nadu), avg productivity - 2700, min productivity - 900 (Assam)
    - World - max productivity - 8900 (US)
  + **Cotton**
    - India - max productivity - 750 (Punjab), avg productivity - 500, min productivity - 350 (Maharashtra)
    - World - max productivity - 1900 (Australia)
  + **Gram**
    - India - max productivity - 1450 (Andhra Pradesh), avg productivity - 950, min productivity - 650 (Tamil Nadu)
    - World - max productivity - 1650 (Ethiopia)
  + **Mustard Oil Seeds**
    - India - max productivity - 1700 (Gujarat), avg productivity - 1200, min productivity - 250 (Tamil Nadu)
    - World - max productivity - 3600 (UK)

**Conclusion**

* + For the whole country, we can divide different crops into the green revolution affected high productivity regions and non-GR affected low productivity regions. Whereas India avg tells us how much GR has been successful for that crop for the whole country for example where the national avg is close to India’s maximum, those crops are benefited more. Whereas, where India’s avg is close to the low productivity regions, there, we can say that those particular crops have not benefited much from the green revolution. For example rice and wheat seem to have benefited, maize has benefited less, and also cotton, Gram has also benefitted less from GR. Mustard as an oil seed has moderately benefited.
  + On the other hand, when we compare the maximum than is the GR region in different states with the country maximum in the world for different crops, we find that even the GR regions are producing relatively much less up to 3/4th to less than half for most of the crops. This implies that even our GR regions are not close to the maximum productivity possible for various crops and hence even in our GR regions more productivity improvement is possible.
  + Hence, the ideal goal of maximizing productivity and overall production has not been achieved fully for all crops and in almost all regions.
  + GR has not reached all the parts of the country and only a few states have seen increased productivity whereas most states have medium or low productivity.

* + **Other challenges related to GR/ill side-effects of GR**
  + We have already seen that because GR crops were introduced only in a few regions hence, only a few states/regions have benefited from GR. mostly Punjab, Haryana, UP in north, Andhra Pradesh, TN and parts of Karnataka, some parts of Maharashtra and Kerala in South. This has led to regional disparities within the country where some states have benefitted more and on the other hand, other states have benefitted much less and still face rural poverty as in parts of Chhattisgarh, Jharkhand, Odisha, Bihar, Western UP, parts of Maharashtra,  Telangana, Assam, etc.
  + Intra-regional disparity - because GR has benefitted only a handful of large (more than 10 hectare) and medium (4-10 hectare) farmers in the country. Large farmers account for nearly 0.5% of total farmers, having around 17% of total farmland. And medium farmers around 4% of total farmers, have around 20% of total farmland.
  + On the other hand, the marginal and small farmers who account for nearly 85% of farmers in India and have around 45% of the farmland have mostly not benefitted from the GR even in the GR regions. Hence, this has created intra-regional disparity.
  + It has also led to an imbalance between crops as GR has focussed only on grains like wheat, rice, and to some extent maize. Also cash crops such as cotton. Whereas, coarse grains such as jowar, bajra, ragi, legumes, oilseeds, etc have not benefited much.
  + India is still a net importer of oilseeds and legumes.
  + Even the govt support as MSP has not been effective except for a few crops. Even traditional varieties of seeds have been side lined by the high-yielding variety making agriculture high-input agriculture for farmers. Hence, we are losing our traditional Agri varieties. As these were drought-resistant and robust to weeds and pests.
  + Mechanization has led to rural unemployment.
  + Proper field selection and soil testing are not done so technically not suitable crops are grown.
  + Improper field preparation
  + Depletion of groundwater
  + Wastage of energy and power etc.
  + Improper use of chemical fertilizers -> concentrated chemical in soil, water pollution leading to eutrophication.
  + Use of excessive chemicals like pesticides/weedicides etc. leading to pollution of persistent organic pollutants - biomagnification, bioaccumulation, leading to long-term extremely harmful health impacts like genetic diseases.

**Future of Indian Agriculture**

* + The concept of sustainable agriculture has already evolved and the basic characteristic of such sustainable agriculture includes -
  + It should be ecologically sound agriculture.
  + It should be economically viable. Even small farmers should be able to practice and earn from it.
  + Socially just which means all sectors of society should benefit.
  + It should be humane. It should have compassion for all living forms.
  + Easily adaptable.
  + It should bring parity between different generations so that, the future generations’ capacity is not compromised to fulfil our needs.

#### *Evergreen Agriculture/Revolution*

* + The concept of the Evergreen Revolution has evolved after the challenges of the Green Revolution and they were highlighted by different scholars like Dr. APJ Abdul Kalam as well as MS Swaminathan in their writings.

**Characteristics -**

* + Blending best practices of traditional knowledge with modern technology.
  + Bringing together the farmer and the corporate sector in such a manner so as to benefit both the farming community as well as the business community e.g. contract farming.
  + Integrated Farming Systems where the different parts of the agriculture such as crops, animals, bees, etc. are integrated to better manage resources and avoid wastage.
  + Ecological farming, not harming ecology.
  + Organic agriculture, less/no use of chemicals.
  + Green Agriculture - conserve the natural environment, picking the indigenous varieties.
  + Agro-Forestry- plants and trees are grown, which improves the forest cover also. The product is used in agriculture as fertilizer etc.
  + Mixed Cropping - different crops are grown, climate-resilient farming.
  + Judicious use of water and land resources.
  + Use of modern biotechnology in an ecologically sustainable manner without affecting other species.
  + Proper development of farm research.
  + Developing a farming system for nutrition rather than just food security.
  + Safeguarding the biological diversity so that indigenous variety is not lost.
  + Proper monsoon management - synchronizing the complete agriculture cycle with the monsoon cycle every year using better monsoon prediction methods. It will ensure the right crop selection and minimize the need for external irrigation.
  + Using new methods like Climate-smart agriculture - using practices and growing crops in tune with climate change. Precision agriculture - highly scientific methods are used to identify the precise need for Agri inputs, ensuring no waste.

#### *The Manufacturing Sector*

**Evolution**

* + **From ancient times to the arrival of European colonizers**
    - Manufacturing was done in cottages, hence, also called cottage industries. Where the artisans did value addition to mining, agricultural, and forestry resources.

* + **2nd phase from Industrial Revolution (the 1770s) till 1853**
  + European colonizers required raw materials for the factories in their own countries and they also needed market access for their manufactured goods. Hence, the Europeans suppressed the traditional cotton industries in India which was the traditional manufacturing industry in India, so as to save the raw material from being consumed in the cottage industries and also took the raw material to their countries. This way they got access to the Indian markets at the cost of deindustrializing the traditional industries in India. Hence, over a period, as the traditional manufacturing system got destroyed, the artisans became landless laborers in the rural area whereas, in the urban areas they were turned into urban unskilled labour. Hence, from being a net exporter of cottage industry-produced goods, India gradually turned into a net importer of modern European industries produced goods. And depended on European factories for all produced goods.
  + During the second phase, many traders helped the Europeans in collecting the raw materials from the rural area (hinterland) and bring them to the port location from where they were exported or taken to Europe. The traders also helped in selling the European products to the Indian markets. And this way, helped the Europeans in covering the local Indian market. This way zamindars worked for the Britishers in rural areas, the same way, the traders worked for the Britishers in manufacturing good markets and trading raw material. Hence, earned favours from the Europeans. They also gradually became rich with a good amount of capital.

* + **3rd Phase (From 1854 to 1947)**
  + This was the beginning of modern industries and the creation of new major industrial regions.
  + Source for facts related to  industrial regions: NCERT

* + **Causes**
    - Traders had capital
    - Traders had access to low-end markets
    - They had access to raw materials from rural areas.
    - Traders had access to technology and machinery.
    - They also had access to port locations like Mumbai & Kolkata.
    - Labour was also available.
    - Government policies supported.
    - Transport i.e. introduction of railways.
    - Power & energy availability.

* + **Regions**
  + **Mumbai-Pune Industrial Region**
    - First industrial region
    - Started with the Cotton-textile industry followed by the chemical industry, engineering industry, food processing industry, etc. developed.
    - Later on, Refinery related petrochemical industries developed.
    - Even post-independence, the region grew.

* + **Hugli (Kolkata) Industrial Region**
  + **Factors that aided industrialization -**
    - It had jute raw material
    - It was the capital of British India till 1911.
    - By 1921, the Kolkata industrial region accounted for nearly two-thirds of the total factory employment in India.
    - Started declining due to -
      * Partition of Bengal
      * Shifting of capital
      * Partition of India
    - Labour union supportive governments post-independence.
    - Growth of Chhota-Nagpur Industrial Region nearby.

* + **Gujarat Industrial Region (the 1860s)**
  + **Factors -**
    - Proximity to the textile industry region. Many of the capital-rich traders in Bombay were from Gujarat. Gujarat region has a history of trade and business.
    - Port location
    - Cotton coming from Punjab region was crossing Gujarat before reaching Bombay and the European goods going up to Punjab from Bombay were also crossing Gujarat. So setting up industries in Gujarat reduced transport costs.
    - Mumbai had land and labour shortage. Gujarat had both available.
    - Next, the chemical industry, shipbuilding industry, food processing industry, the petrochemical industry grew, milk processing industry, etc. have grown gradually.

* + **Chhota Nagpur Industrial Region**
    - The above three industrial regions supported initially the growth of consumer goods and Agro-processing industries. But most of the machines and steel were still being imported from Britain. But with the setting up of the Tata steel plant in 1907, it led to the beginning of modern capital goods industries in India.

* + **Factors -**
    - The Chhota Nagpur region is the Ruhr of India, a mineral-rich region.
    - Damodar Valley Multipurpose Project made hydroelectric power available.
    - Mineral mining infrastructure provided the transport facility.
    - Local labour from Jharkhand, Chhattisgarh, Odisha, etc.
    - Apart from the Jamshedpur plant much did not happen till post-independence.
    - During the 2nd FYP, the state-owned PSU-led steel plants in Rourkela, Bhilai, Bokaro, Durgapur, etc, led to further growth of the region.
    - But these regions have not grown much till the last one to two decades as the intermediate and consumer goods industry did not grow here due to lack of private participation which was due to lack of infrastructure (both social and physical) by govt investments. Resource exploitation without re-investment in the region.
    - The industrialization in some of the CNP regions picked up after the mineral-rich regions were bifurcated into new states like Jharkhand, Chhattisgarh, etc. but still not much development seen.

* + **Delhi-Gurugram & surrounding region**
  + **Factors -**
    - Delhi has availability of old urban artisan population
    - Shifting of capital in 1911. With this govt policies favoured it.
    - Transport facilities were already there since ancient times.
    - It has a wide surrounding area which it serves.
    - Delhi gained from partition in some ways to support regions of Punjab, Haryana, etc.
    - Green Revolution around Delhi - Agro-processing, leather, chemical, etc.
    - Petrochemical industry due to refineries nearby i.e.. Mathura.
    - Port connectivity is there.
    - Gradually the automobile, IT industry, etc. grew.
    - Hence, Delhi is one of the major industrial regions in India.

* + **Bengaluru-Chennai-Madurai Industrial Region**
    - Industrialization did not pick up too much during the British period. Some of the traditional industries such as the silk industry, matchbox industry were there but the development of most industrial regions started mostly after India’s independence.
    - Industrialization started around Bangalore with the growth of Electrical, Electronic Engineering Industry i.e. Telecom industry, Hindustan Aeronautical Ltd., etc.
    - With Green Revolution, other industries i.e.. engineering tools, Agro-processing, etc. grew.
    - Gradually chemical, textile, etc. developed.
    - Gradually due to high savings (cultural reasons) and higher education, the engineering sector-related jobs have increased. This is the fastest-growing industrial region and is presently one of the biggest industrial regions. IT sector also grew.

* + **Visakhapatnam-Hyderabad Industrial Region**

* + **Factors -**
  + Visakhapatnam - biggest natural harbour and port of East Coast.
  + transport, shipbuilding industry.
  + Labour availability from Andhra and nearby regions
  + It has grown post-independence.
  + Post Green Revolution, Agro-processing industries came up.
  + Steel industries were established by getting iron ores from Bailadila mines in the Chhattisgarh region.
  + Vizag refinery, hence, petrochemical industries.
  + In Hyderabad etc. IT industry has grown.
  + This way the whole industrial region has grown.

**Kollam-Trivandrum-Kochi Industrial Region**

* + **Factors -**
    - The Cochin and Trivandrum ports
    - The coir industry (coconut fibre industry) is unique to this region.
    - The food processing industry (marine food)
    - Spice, coffee, tea processing industries
    - Refineries in cochin - petrochemical industries
    - Consumer goods industries due to the large tourism industry.
    - IT industry has also grown due to investment in social sectors.

**Manufacturing Clusters**

* + It is basically bringing together the centre and state govt for the promotion of different industrial regions such as manufacturing clusters/zones/parks etc.

#### *Industrial and Economic Corridors*

* + They have been promoted by the govt so as to cause industrial development, increased employment.
  + Supported by transport corridors like the Golden Quadrilateral road network, Railways dedicated freight corridors, the govt has initiated the development of the Delhi-Mumbai, Chennai-Bengaluru, Bengaluru-Mumbai, Amritsar-Kolkata, Vyzag-Chennai Industrial Corridor - all under national industrial corridor development and implementation trust.
  + Within these industrial and economic corridors, also the plan for **National Investment & Manufacturing Zones (NIMZ)** as large integrated industrial townships have also been developed by the government. With 8 NIMZ in Delhi-Mumbai Industrial Corridor and 12 NIMZ in other Industrial & Economic corridors.

#### *Infrastructure*

* + Infrastructure is the base on which other things grow.
  + In a country, there are two types of infrastructure - physical and social.
  + Social infrastructure includes health, education, social security, etc. it creates Human resources.
  + Physical infrastructure includes transport, communication, and power.
  + Power - India Year Book - Renewable, Thermal and Nuclear power. Also covered in Science and Tech.
  + Communication - also covered in Science and Tech

#### *Transport*

* + **Air Transport -**Aviation Policy - sources - India Year Book and Eco Survey
  + Land Transport -Road, Railway & Urban transport (Mass Rapid Transport System)
  + Water Transport - Port & Inland
  + **Transport cost**- waterways are the cheapest, then railways, road and finally air transport.

#### *India Railways development*

* + **Phase 1 (pre-independence)**
  + The pre-independence phase of Indian railways was more a British tool for commercial exploitation of India and Britishers introduced railways as early as 1853 so as to maximize the exploitation. also administrative, strategic exploitation with faster transport of large volumes of cargo and men.
  + Hence, the railways benefitted the British and were an overall profitable venture for them with more focus on goods transport than peoples transport

* + **Phase 2 (Post-Independence)**
  + Post-independence, the focus of Independent India was more on welfare and hence the focus of railways was shifted from goods transport to passenger transport. That too at a subsidized rate or rather by cross-subsidization which means that goods transport was overcharged whereas passenger transport was subsidized. This ultimately led to a reduced share of goods transport in railways and most of the goods transport shifted to roadways. Which was a costlier mode of transport and hence, adversely affected the manufacturing sector pricing. Therefore, overall negatively affecting the manufacturing sector.
  + Further, the populist policies of the govt did not leave the scope for the return of the already overloaded passenger transport infrastructure back to the goods transport.
  + As the railways gradually realized the challenge and also to increase the share of the goods transport, then Dedicated Freight Corridor (DFC) project was launched where greenfield railway projects were to be made from scratch to ensure completely new infrastructure is created which will be used solely for freight transport with enhanced infrastructure having wider, higher, longer and faster trains (high capacity) to move the goods faster. This way, the Golden Quadrilateral Freight Corridor Project was launched with different corridors such as Western DFC, Eastern DFC, East-West DFC, North-South DFC, East Coast DFC, and southwest DFC.

**Port Development**

* + Under the port development project, the govt of India’s most ambitious plan is the **Sagarmala Project**. Which is strategically and economically important for the country.
  + It involves the development of 12 major ports and 200 minor ports of the county. With the background of port-led development, port infrastructure enhancement, and faster connectivity to the hinterland regions. Other aspects include the development of shipbuilding and recycling, logistics park, warehousing zones, faster connectivity to interior regions, offshore storage and drilling platforms, specialized ports for various activities, offshore renewable energy projects, etc.

**Inland water transport**

* + Inland water transport in India accounts for less than 1% of the cargo transport of the country despite having **14500 km**of navigable waterways. This is because the infrastructure for commercial transport through waterways is not developed.
  + Compared to this in most of the developed countries, the share of inland cargo transport through waterways ranges from **20 to nearly 45%** in the USA, Europe, China, etc. giving them cheaper transport advantages.
  + Hence, the government in the recent past has added 105 new National Water Ways taking the total number to **111**new **National Water Ways**from the previously existing 6 NWW from 1986 till 2016. Hence, now the govt will be focussing on the development of older as well as newer waterways.

**Mass Rapid Transport System**

* + **Traditionally**-
    - Roads developed mostly with private and some public transport - unsynchronised - traffic jams, slow speed, accident, energy cost, time loss, etc.
    - City Trains - poor infrastructure, share infra with railways
  + **Modern MRTS**
    - Characteristics -
      * Synchronized, large volume (mass)
      * Faster (rapid)
      * Like faster conveyor belts in a factory.
      * Dedicated infrastructure i.e. Metro, Monorail, etc.
      * Shared BRT - low floor, high volume buses.

**Population & Tribes**

* + **Population Evolution in India**
  + As per this model, there are 4 stages.
  + The **1st stage** implies the country has a traditional agrarian society with high birth rates and high death rates due to a lack of family planning measures and medical facilities. Hence, the total population remains low and fixed.
  + India was in this stage in the period **1901-21**called the **stagnant population period**of India.

* + **2nd stage -**Also called the early transition stage.
  + It is a stage of public availability of medical facilities. The death rate starts to decline. But the birth rate remains constant due to a lack of family planning measures as well as a lack of willingness to have fewer children due to the traditional mindset.
  + In this stage, the gap b/w the death rate and the birth rate is the population growth rate. Hence, the growth rate goes on increasing and the population also goes on increasing steadily.
  + India was in this stage during **1921-51**. Known as the **period of a steady growth**of India’s population. During the stagnant population stage, the population was **23-25 crores**. In the 2nd stage, it reached **36 crores**.

* + **3rd stage**
  + It is the stage of declining death rate, coming to the lowest constant death rate. Also, started a decline in the birth rate. Hence, the population growth rate starts to decrease but initially, the population continues to increase at a high total value. Only later on the total population growth also starts to slow down.
  + During **1951-81**, India was in a **high growth period**where the population increased from 36 to **71 crore**.
  + **From 1981 till present**we are in the late 3rd stage of high total growth but with a **decreasing trend**.

* + **4th stage**
  + The population becomes constant as birth and death rates both become lowest and constant at a **population replacement ratio of 2.1 children per couple** or 21 children for 10 sets of couples.
  + Most of the developed countries are in this stage.
  + India is still to reach this stage in another 15-20 years.
  + In some economically developed countries where people do not prefer having children in general, they might have a decreasing population trend which is not good for the country such as some Scandinavian countries, Japan, etc. as they will have more retired people than young working people after some time.

* + **Population Distribution**
  + In India, half of the population lives in Indo-Ganga-Brahmaputra plains with higher density in lower Ganga plains.
  + Other regions apart from mountains, desert and forest have moderate density.
  + Coastal plains have a high density.
  + The mountains, deserts, forests, and islands have low density.

* + **Tribes**
  + **Distribution**
  + The tribal distribution in the country is mostly found in the mountainous, forested plateau or desert, or island regions.
  + For example -
  + The major regions of the tribal population are -
    - Western Himalayas - the hilly area of Ladakh, J&K, Himachal Pradesh, Uttarakhand
    - Sikkim and the 7 NE states where the four states of Arunachal, Meghalaya, Mizoram, and Nagaland have more than 90% population as tribal.
    - Plateaued hilly areas of Central India (region b/w Narmada & Godavari) - Chhattisgarh, Odisha, Telangana.
    - The eastward regions of Jharkhand and West Bengal to the Central Indian region - these two regions have around 75% of the total tribal population.
    - Hills of Karnataka, Tamil Nadu, and Kerala.
    - In Western India - drier parts of Gujarat and Rajasthan
    - Lakshadweep
    - Andaman & Nicobar
  + As per the constitution of India, provisions for scheduled tribes, the number of the individual ethnic groups **notified as scheduled tribes** is **705**. Accounting for **10.5 crore**people as per 2011 census - **8.6%**population of India.
  + Madhya Pradesh accounts for the highest population of tribes in India.
  + Delhi, Punjab, and Haryana have no scheduled tribe population.
  + The state of Odisha has the highest number of scheduled tribes - around 62.
  + Within the STs, the tribal population that has the following characteristics are called **Primitive Tribal Groups** earlier and since 2006, **Particularly** **Vulnerable Tribal Groups (PVTGs)**. -
    - Pre-agriculture level of tech
    - Stagnant or declining population
    - Extremely low literacy
    - Subsistence level of economy
  + There are **75**PVTG groups presently with the highest number 13, such groups in Odisha.
  + They were identified by the **Dhebar Commission** in **1961**, starting with 52 tribes and later addition of another 23 tribes (total - 75).
  + The **Sahariya**PVTG found in MP, Chhattisgarh, and Rajasthan have the largest PVTG population of nearly 4,50,000.
  + The total PVTG population is around 28 lakhs. And only 12 of the PVTGs have a more than 50,000 population with the 2016 count of Andaman & Nicobar, the smallest PVTG group is the **Sentinelese**- having a total population of only 15 people.
  + Andaman & Nicobar - 6 tribal groups, 5 are PVTGs, 1 (Nicobarese) is the non PVTG.
  + **Nomadic tribes** - 315 tribes (all under STs)
  + **Denotified tribes** - 198 tribes, before 1952 they were referred to as Criminal Notified Tribes.