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INDIAN GEOGRAPHY

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2

Index

UNIT 1: PHYSICAL SETTING OF INDIA

UNIT 2: RESOURCES OF INDIA

UNIT 3: ECONOMIC ACTIVITIES IN INDIA

UNIT 4: DEMOGRAPHICS OF INDIA

UNIT 5: INFLUENCE OF GEOGRAPHY ON POLITICAL DEVELOPMENTS OF INDIA

❑❑❑❑❑

UNIT - I

PHYSICAL SETTING OF INDIA

India is a South-Asian country lying entirely in Northern Hemisphere. India comprises most of the Indian subcontinent situated on the Indian Plate, the northerly portion of the Indo-Australian Plate. Having a coastline of over 7,000 km (4,300 miles), most of India lies on a peninsula in southern Asia that protrudes into the Indian Ocean.

India is bordered by Pakistan, the People's Republic of China, Bangladesh, Myanmar, Nepal, Bhutan and Afghanistan. Sri Lanka and the Maldives are island nations to the south of India.

The Indian mainland extends between 8°4'N to 37°6' N latitudes and from 68°7' E to 97°25' E longitudes. Thus the latitudinal and longitudinal extent of India is of about 29 degrees. It measures about 3,214 km from north to south, and 2,933 km from east to west. It has a land frontier of about 15,200 km. The total length of the coastline of the mainland, Lakshadweep Islands and Andaman and Nicobar Islands is 7,516.6 km.

The geography of India is extremely diverse, with landscape ranging from snow-capped mountain ranges to deserts, plains, hills and plateaus. It stretches from the snow-capped Himalayas in the north to the sun-drenched coastal villages of the south and the humid tropical forests on the south-west coast, from the fertile Brahmaputra valley on its east to the Thar Desert in the west.

The drainage system of India comprises Himalayan, Peninsular and Inland Drainage. The rivers of India mainly originate from one of the three main watersheds which are: The Himalaya and the Karakoram ranges; Vindhya and Satpura range in central India and Western Ghats in western India.

The physiographic divisions of India influence its climate and have an impact on climatic conditions of India including temperature, atmospheric pressure, wind system or precipitation. India has a monsoon type of climate. The year is divided into four seasons in India: cold weather season, hot weather season, advancing south-west monsoon season and retreating monsoon season.

However due to change in climate caused due to natural and anthropogenic reasons, India is vulnerable to disasters - floods, tropical cyclones, earthquakes, landslides, tsunami, drought, etc. These disasters cause loss of lives and damage to property, affecting the overall socio- economic development of the country.

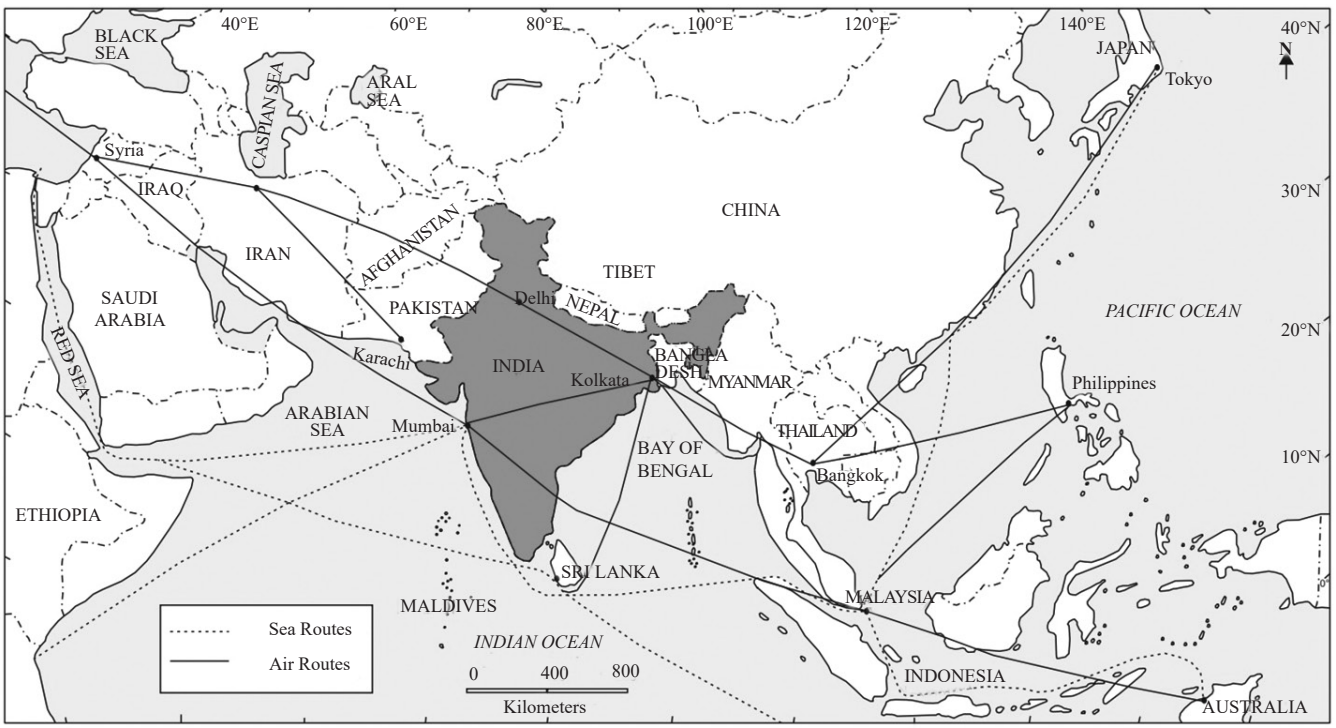
01
CHAPTER

India: Location & Size

India is one of the oldest and greatest civilizations of the world. It is located entirely in the northern hemisphere. India is the seventh largest country in the world and ranks second in population. It covers an area of 32, 87,263 sq.km. The country stands apart from the rest of Asia, marked off as it is by mountains and the sea, which give her a distinct geographical entity. Bounded by the Great Himalayas in the north, it stretches southwards and at the Tropic of Cancer tapers off into the Indian Ocean between the Bay of Bengal on the east and the Arabian Sea on the west. In this chapter we will learn about the locational setting of India and its size.

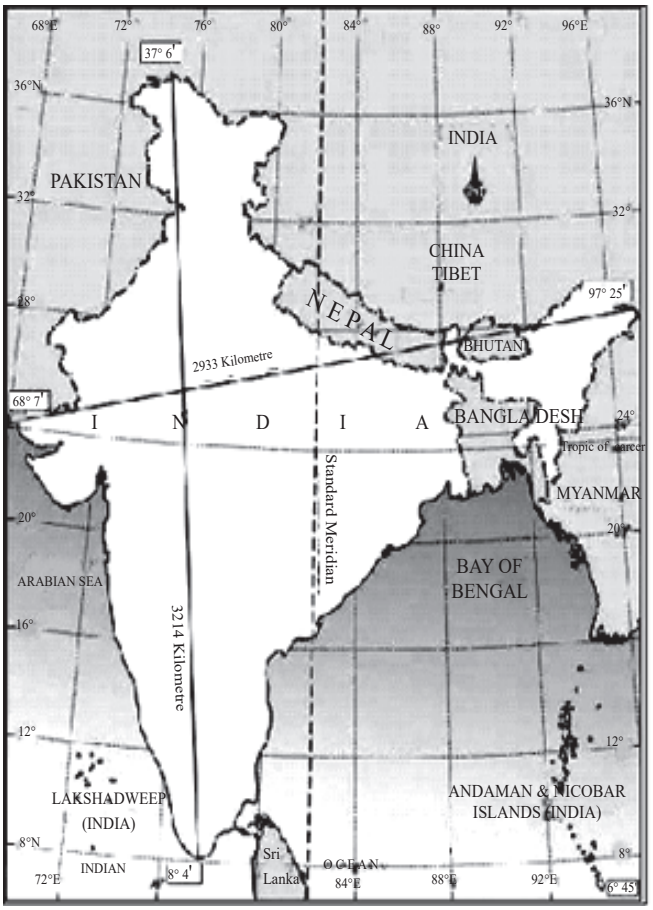
Location of India

India is a country of vast geographical expanse. It lies entirely in the Northern hemisphere. It is strategically located in the Indian Ocean and commands important sea routes connecting Europe and Africa, South-East Asia, East Asia and Oceania. In ancient times too, its location was important from the strategic perspective as it was located on trade and cultural routes connecting various parts of the world.

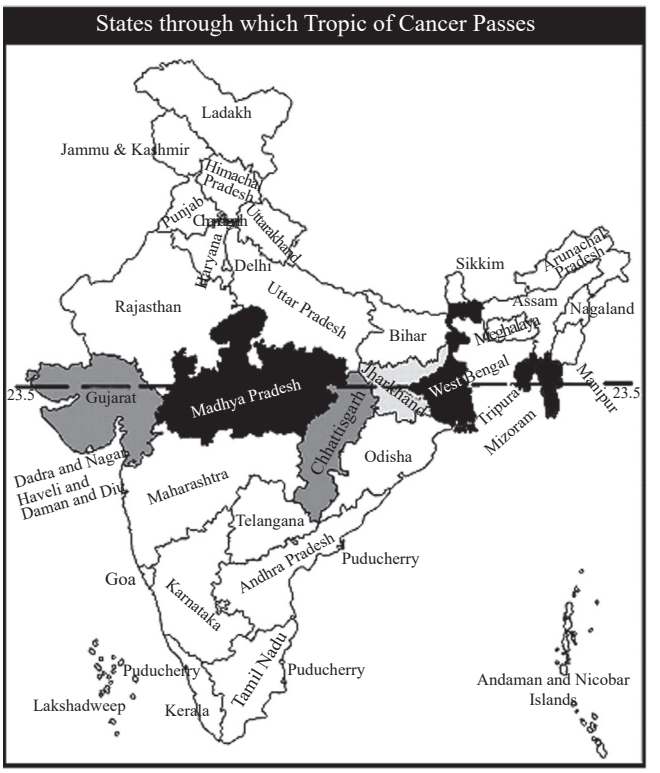


Location of India in Asia with reference to Important Trade Routes

- Mainland India extends between latitudes 8°4′ N and 37°6′ N and longitudes 68°7′ E and 97°25′ E. Thus, the latitudinal and longitudinal extent of India is about 30°.
- The north-south extent is about 3,214 km and the east-west extent is about 2,933 km.
- India has a land frontier of 15,200 km and a coastline of 7,516.6 km.
- On the south, India projects into and is bounded by the Indian Ocean in particular, by the Arabian Sea on the west, the Lakshadweep Sea to the southwest, the Bay of Bengal on the east, and the Indian Ocean to the south.



- Tropic of cancer (23°30′ N) passes through eight states of India- Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram.



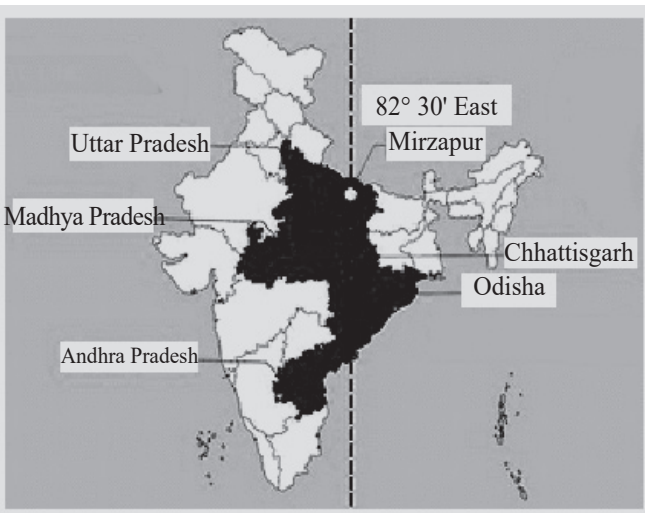
Difference between E-W and N-S Distance

- Though the Latitudinal and Longitudinal extent is almost the same, the actual distances do differ considerably. Why is it so? This is because the east-west distance between two successive meridians of longitude along the equator is at its maximum - 111 km. This, however, goes on decreasing as one moves from the equator to the poles, where it is zero.
- This is because all the meridians of longitude merge in a single point at the poles - both North and South.
- On the other hand, the north-south distance between any two successive parallels of latitude along any meridian of longitude remains almost uniform, i.e., 111 km.

Implications of Latitudinal and Longitudinal Extent of India

- In terms of Latitude, the Tropic of Cancer (23°30′ N) divides the country into almost two equal parts. The southern part of the country extends in the tropical zone whereas the northern part lies in the sub-tropical zone.
  - This is responsible for large variations in land forms, climate, soil, natural vegetation, agricultural practises and socio-economic life of the people.

- In terms of ***Longitude***, the extent of 30° results in time difference of 2 hours between the easternmost and westernmost parts of the country.
  - The Sun rises in the Easternmost part 2 hours earlier than in the westernmost part. However India has adopted only a single time zone with the Indian Standard meridian passing through 82°30′ E. The Indian Standard Time is 5 hours 30 minutes ahead of the Greenwich Mean Time (GMT).
  - It means that all the clocks in India, irrespective of the region, shows the same time.



02
CHAPTER

India: Geological Structure

The geological structure of a country helps in understanding the types and character of rocks and slopes, the physical and chemical properties of soils, the availability of minerals, and the surface and underground water resources. The chapter mentions the details of geological structure of India.

The geological structure of a country has a direct impact on the socio-economic development of the people of a country or region. It helps in understanding the following:

- The types and character of rocks and slopes;
- The physical and chemical properties of soils;
- The availability of minerals; and
- The surface and underground water resources.

The geological history of India is complex and varied which began with the formation of earth's crust, deposition of sedimentary rocks, orogenesis and laying down of alluvial deposits.

The geological history of India is characterized by three major events -

(i) Peninsular India was part of the old landmass since the formation of the Earth's crust

(ii) Upheaval of Himalayas in tertiary period

(iii) Aggradation of Indo-Gangetic plain during Pleistocene period. This continues till present via the sedimentation in the floodplains of the rivers and lower part of Gangetic plain.

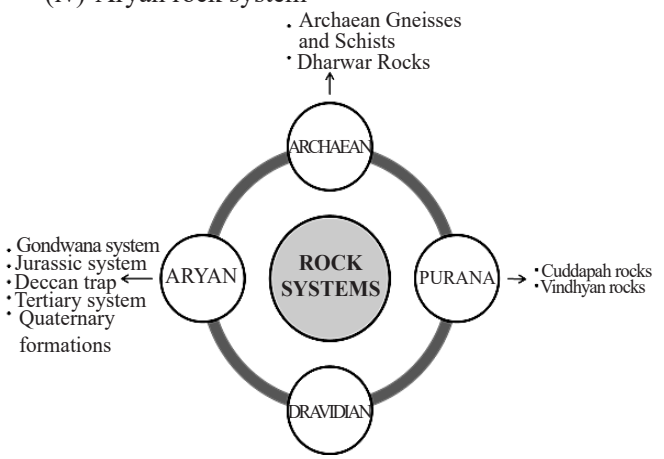
Based on this complex and varied geological history, the Geological Survey of India has classified rock systems of the country into four major divisions:

(i) Archaean rock system

(ii) Purana rock system

(iii) Dravidian rock system

(iv) Aryan rock system



Archaean Rock System

The term 'Archaean' which refers to the oldest rocks of the earth's crust, was introduced by J.D. Dana in 1782.

- Archaean era (prior to 2.5 billion years; Precambrian Period) is known for the earliest phase of tectonic evolution which was marked by the cooling and solidification of the upper crust of the earth's surface. This is represented by the exposure of gneisses and granites, especially on the Peninsula.
- This rock system forms the core of the Indian Craton i.e. block of Indian Subcontinent of Gondwanaland.
- The Archaean group of rocks consists of two systems -

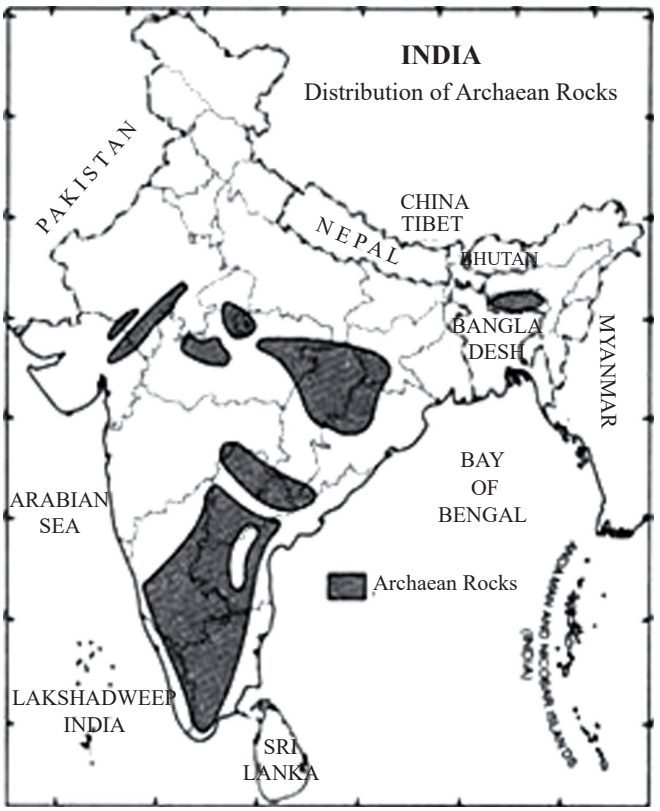
  (i) Archaean System: Granites and Gneisses

  (ii) Dharwar System: First metamorphosed sedimentary rocks

Archaean Gneisses and Schists

- **Geologic Time:** Archaean rocks are the oldest rocks formed in the pre-Cambrian era.
- These rocks are formed due to the solidification of molten magma.
- **Features:** The features of Archaean rocks are:
  - The rocks are primarily gneisses and granites.
  - These are all azoic or unfossiliferous i.e. devoid of any form of life.
  - They are thoroughly crystalline.
  - They are extremely contorted and faulted and practically devoid of any sediment.
  - They have a well-defined foliated structure.
  - These rocks are largely intruded by plutonic intrusions.
  - They often underlie the strata formed subsequently and the system is generally known as the basement complex or fundamental gneisses.
- **Occurrence:** The Archaean rocks cover two-thirds of the peninsular India. They also occur in roots of the mountain peaks all along the Greater Himalayas, trans-Himalayan ranges of Zaskar, Ladakh and Karakoram.

- Economic Significance: Archaean rocks are repositories of mineral wealth of India. These rocks are rich in both ferrous and non-ferrous minerals like iron ore, copper, manganese, mica, dolomite, lead, zinc, silver and gold.



Dharwar System

- **Geologic Time:** These rocks are Proterozoic formations with the geologic time extends from 2500 million years ago to 1800 million years ago.
- **Features:** The features of Dharwar rocks are:
  - The weathering of the Archaean rocks yielded the earliest sediments and formed the oldest sedimentary strata, the Dharwar system.
  - These are the first metamorphosed sedimentary rock systems
  - They are composed largely of igneous debris, schists and gneisses
  - These are found today in metamorphic forms and do not contain fossils.
  - These rocks are highly metalliferous
- **Occurrence:** These rocks occur in scattered patches in parts of Karnataka, Tamil Nadu, central and eastern parts of Chotanagpur plateau, Meghalaya plateau and Mikir hills, Aravallis, Himalayan region, etc.
- **Economic Significance:** These rocks are rich in iron ore, manganese, lead, zinc, gold, silver, dolomite, mica, copper, tungsten, nickel, precious stones and building materials.

Purana Rock System

- The Archaean gneiss and the Dharwar rocks underwent further erosion leading to the formation of the Purana Rock system.
- They are mostly sedimentary in nature.
- The Purana rock system is further subdivided into:
  (i) The Cuddapah
  (ii) The Vindhyan

Cuddapah System

- The Cuddapah formations are sedimentary-metamorphic formations.
- These are named after Cuddapah district of Andhra Pradesh due to development of prominent outcrops of Cuddapah rocks in the region.
- **Features:** The features of Cuddapah rocks are:
  - These are made of shales, slates, limestone and quartzite.
  - The other principal rocks of Cuddapah system are sandstones, inferior quality of iron-ore, manganese ore, asbestos, copper, nickel, marble, jasper, building material and stones for interior decoration.
  - These rocks are generally without fossils.
- **Occurrence:** The Cuddapah system occurs in Cuddapah and Kurnool districts of Andhra Pradesh; Chhattisgarh; Rajasthan- Delhi to south of Alwar and the Lesser Himalayas.

03
CHAPTER

India: Physiography

The present geological structure and physiography of India is an outcome of endogenic and exogenic forces and lateral movement of the Indian plate. Indian plate was to south of the equator millions of years ago. This plate is moving northward and this movement is still continuing. This movement has significant consequences on physical environment of Indian subcontinent and has given shape to present physiographic divisions of India.

India is bounded by the seawaters from three sides and the young Himalayan mountains system separates it from Asia on its northern side. As a result of this, it has become an independent entity, and it is known as the Indian subcontinent.

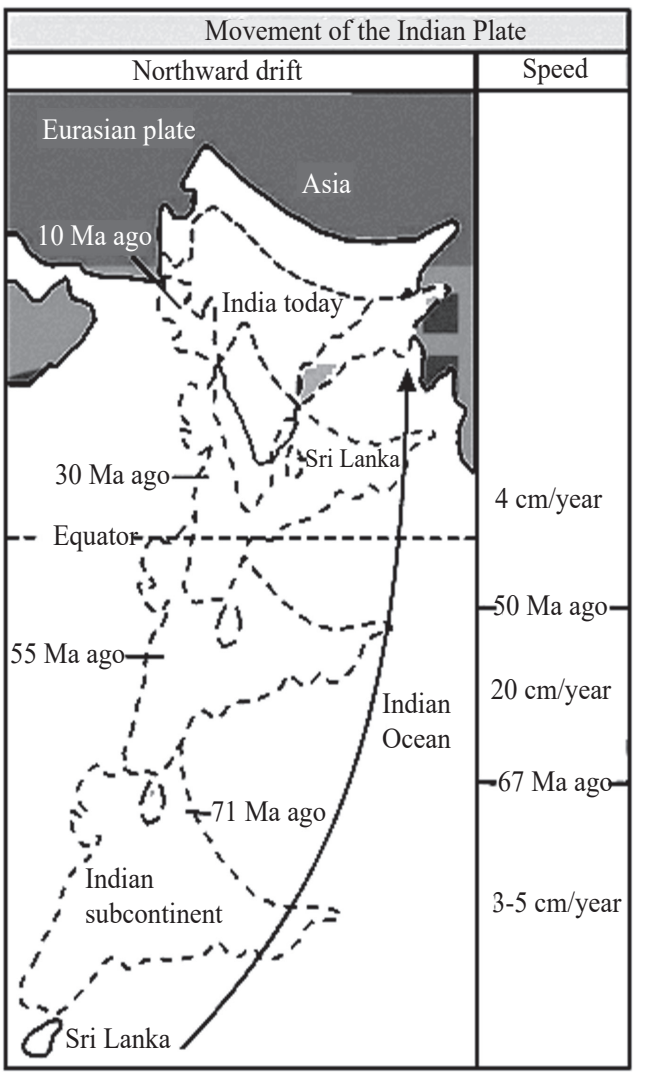
- The country shows a huge diversity in physical and structural features as its land comprises various natural features like snow-clad folded mountains in the north, plateaus in the south and plains in between them.
- The present structure and physiography of Indian landmass has evolved over a very long time as a result of endogenic and exogenic forces.

The Indian Plate

- The Indian plate is a major tectonic plate lying near the equator in the Northeast Hemisphere.
- It is bordered by four major plates -
  (i) The Eurasian (consisting of Europe and Asia) plate lies to the north,
  (ii) The Arabian plate to the west,
  (iii) The African plate including Somali to the south west, and
  (iv) The Australian plate to the south east.
- The minor Burma plate lies to the east.

Drift of Indian Plate

- The Indian plate was once an integral part of the Gondwanaland during the late Palaeozoic era.
- Indian plate began to separate from the Gondwana at about 165-150 million years ago due to mantle plumes.
- After separating from Gondwana in a sequential manner, the Indian plate moved northeast to north direction at a uniform rate and got welded with the Asian plate.
- This collision was the source of formation of Himalaya mountain range. The great plains were formed by the deposition of sediments brought by Himalayan Rivers.
- The Deccan Traps were formed as a result of the Indian plate passing over the reunion hotspot.
- At present, the Indian plate is moving at a speed of 4 cm per year.



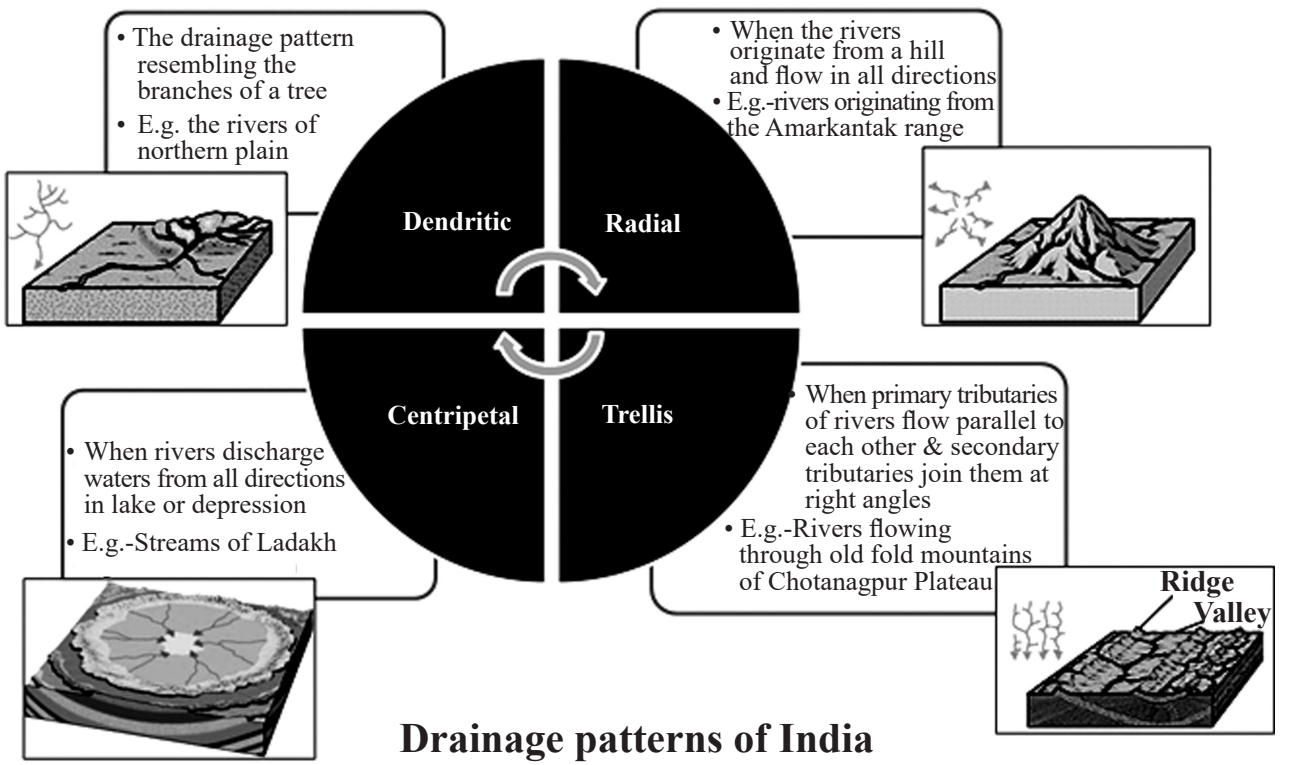
04
CHAPTER

DRAINAGE SYSTEM OF INDIA

Rivers are important lifeline of an economy. India is blessed with hundreds of large and small rivers, which drain the length and breadth of the country. The annual yield of water in the rivers of the country is 18, 58,100 million cubic meters, 1/3rd (33.8%) of which is contributed by the Brahmaputra followed by the Ganga (25.2%), the Godavari (6.4%), the Indus (4.3%), the Mahanadi (3.6%), the Krishna (3.4%), and the Narmada (2.9%). Indian rivers can be broadly divided as Himalayan and Peninsular rivers. The network of well-defined channels through which water flows is called drainage system. The chapter provides details of drainage systems of India- the Himalayan Drainage System and the Peninsular Drainage System.

The flow of water through well-defined channels is known as drainage and the network of such channels is called a **drainage system**.

- A river drains the water collected from a specific area, which is called its **catchment area.**
- An area drained by a river and its tributaries is called a **drainage basin.**
- The boundary line separating one drainage basin from the other is known as the **watershed.**
- The catchments of large rivers are called **river basins** while those of small rivulets and rills are often referred to as **watersheds.**
- The **drainage pattern of an area is determined by following factors-**
  - Geological time period,
  - Nature and structure of rocks,
  - Topography,
  - Slope,
  - Amount of water flowing, and
  - The periodicity of the flow.

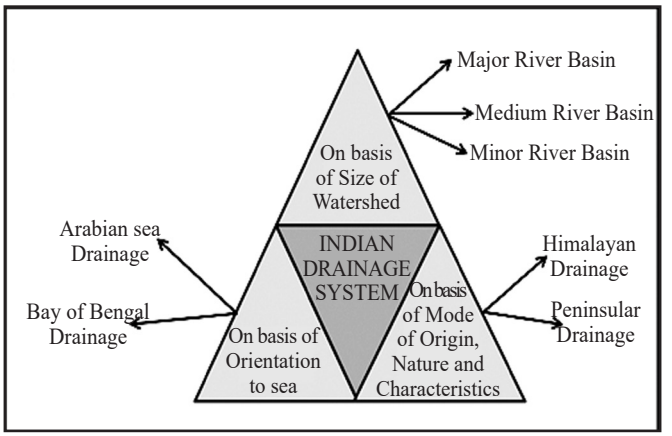


Drainage patterns of India

Classification of Indian Drainage System

Indian drainage system consists of a large number of small and big rivers. It is the outcome of the evolutionary process of the three major physiographic units and the nature and characteristics of precipitation.

Indian drainage system may be divided on various bases:



1. On the basis of Orientation to the Sea

On the basis of discharge of water i.e. orientation to the sea, it may be grouped into:

- **Arabian Sea Drainage:** 23 per cent comprising the Indus, Narmada, Tapi, Sabarmati, Mahi and large number of swift flowing western coast rivers descending from the **Sahyadris** discharge their waters in the Arabian Sea.
- **Bay of Bengal Drainage:** Nearly 77 per cent of the drainage area consisting of the Ganga, the Brahmaputra, the Mahanadi, the Krishna, etc. is oriented towards the Bay of Bengal.

They are separated from each other through the Delhi ridge, the Aravalis and the Sahyadris.

2. On the basis of the size of Watershed

On the basis of the size of the watershed, the drainage basins of India are grouped into three categories:

(i) **Major River Basins:** With more than 20,000 sq. km of catchment area.

(ii) **Medium River Basins:** With catchment area between 2,000-20,000 sq. km

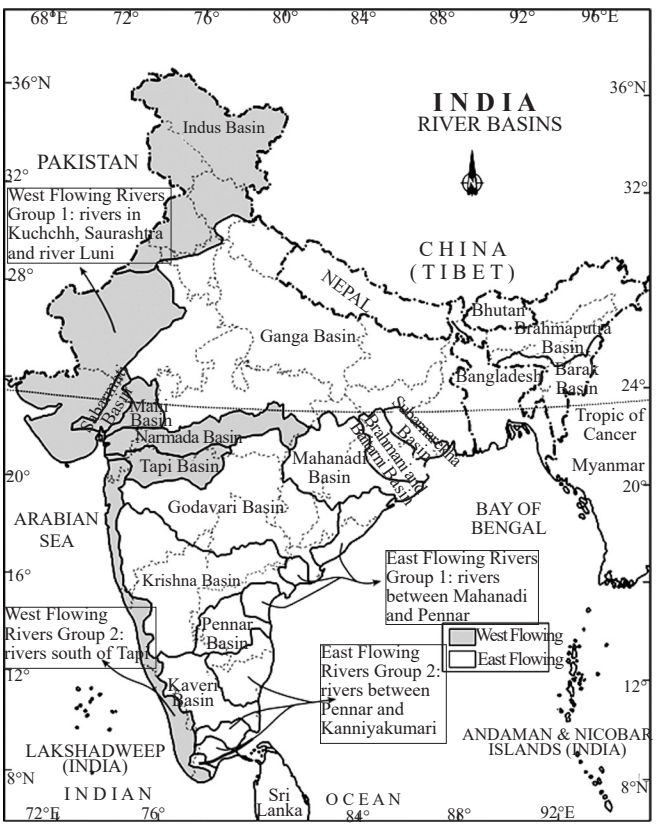
(iii) **Minor River Basins:** With catchment area of less than 2,000 sq. km include fairly good number of rivers flowing in the area of low rainfall.

- The entire country has been divided into 20 river basins or group of river basins, comprising 12 major basins and eight composite river basins.

12 Major River Basins of India	
1	Indus
2	Ganga-Brahmaputra-Meghna
3	Godavari
4	Krishna
5	Cauvery
6	Mahanadi
7	Pennar
8	Brahmani-Baitarani
9	Sabarmati
10	Mahi
11	Narmada
12	Tapti

- The **eight composite river basins** combining suitably together all the other remaining medium (drainage area of 2,000 to 20,000 sq. km) and small river systems (drainage area less than 2000 sq. km) for the purpose of planning and management are:

1	Subarnarekha —combining Subarnarekha and other small rivers between Subarnarekha and Baitarani;
2	East flowing rivers between Mahanadi and Pennar;
3	East flowing rivers between Pennar and Kanyakumari;
4	Area of Inland drainage in Rajasthan desert;
5	West flowing rivers of Kutch and Saurashtra including Luni;
6	West flowing rivers from Tapi to Tadri;
7	West flowing rivers from Tadri to Kanyakumari;
8	Minor rivers draining into Myanmar and Bangladesh.



05
CHAPTER

CLIMATE OF INDIA

The average of weather conditions over a longer period of time is defined as climate. Climatic conditions help to shape various ecosystems and habitats around the globe. Climate affects nearly every aspect of our lives, from our food sources to our transport infrastructure, from what clothes we wear, to where we go on holiday. It has a huge effect on our livelihoods, our health, and our future. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Thus, in the present world with increasing evidences of climate change, the understanding of climate has become inevitable. The chapter describes spatial and temporal distribution of temperature; pressure, winds and rainfall; seasons; Indian monsoon: mechanism, onset & variability and climatic classification of India.

Weather refers to the state of the atmosphere over an area at any point of time. Thus, the weather conditions fluctuate very often even within a day. Climate refers to the sum total of weather conditions and variations over a large area for a long period of time. The elements of weather and climate are the same, i.e. temperature, atmospheric pressure, wind, humidity and precipitation.

Unity and Diversity in India's Climate

Unity in India's Climate

- India has hot monsoonal climate which is the prevalent climate in south and south-east Asia. The monsoon regime emphasises the unity of India with the rest of south-east Asian region.
- The word monsoon is derived from the Arabic word 'mausim' which literally means season. Monsoon connotes the climate associated with seasonal reversal in the direction of winds.

Diversity in India's Climate

- The shape, size, location, latitudinal extent of the country and its contrasting relief, have resulted in diverse climatic conditions in different parts of India.
- These regional variations in climate of India are expressed in the pattern of winds, temperature and rainfall, rhythm of seasons and the degree of wetness or dryness. These regional diversities may be described as sub-types of monsoon climate.
  - Regional Variation in Temperature: In summer, the mercury occasionally touches 50°C in some parts of the Rajasthan desert, whereas it may be around 20°C in Pahalgam in Jammu and Kashmir. On a winter night, temperature at Drass in Jammu and Kashmir may be as low as minus 45°C. Thiruvananthapuram, on the other hand, may have a temperature of 22°C.
  - Regional Variation in Precipitation: There are variations not only in the form and types of precipitation but also in its amount and the seasonal distribution. While precipitation is mostly in the form of snowfall in the upper parts of Himalayas, it rains over the rest of the country.
    - While Cherrapunji and Mawsynram in the Khasi Hills of Meghalaya receive rainfall over 1,080 cm in a year, Jaisalmer in Rajasthan rarely gets more than 9 cm of rainfall during the same period.
    - Tura situated in the Garo Hills of Meghalaya may receive an amount of rainfall in a single day which is equal to 10 years of rainfall at Jaisalmer.
    - While the annual precipitation is less than 10 cm in the northwest Himalayas and the western deserts, it exceeds 400 cm in Meghalaya.
    - The Ganga delta and the coastal plains of Odisha are hit by strong rain-bearing storms almost every third or fifth day in July and August while the Coromandal coast, a thousand km to the south, goes generally dry during these months.
    - Most parts of the country get rainfall during June-September, but on the coastal areas of Tamil Nadu, it rains in the beginning of the winter season

06
CHAPTER

NATURAL HAZARDS & DISASTERS IN INDIA

India is one of the most disaster-prone countries in the world. The locational and geographical features render it vulnerable to a number of natural hazards such as cyclone, drought, floods, earthquakes, fire, landslides and avalanches. The country has well-established cyclone detection and tracking system, flood forecasting and warning systems - covering major rivers and drought monitoring arrangements. Long-term planning and preparedness for disaster mitigation form part of the process of development planning in India. A number of special programs are in operation over many years for mitigating the impact of natural disasters. As the country has been facing natural hazards over centuries, the local communities have developed their own indigenous coping mechanisms.

A hazard is an agent which has the potential to cause harm to a vulnerable target. The terms "hazard" and "risk" are often used interchangeably. However, in terms of risk assessment, they are two very distinct terms. A hazard is any agent that can cause harm or damage to humans, property, or the environment.

The most frequent occurring hazards are:

- **Climatic:** Drought, floods, cyclones, ice, snow, and fog
- **Tectonic:** Earthquakes, Volcanoes, and Tsunami
- **Mass Movement:** Landslides, land creep, rock-fall, and avalanches.

Natural Hazards, Risk, and Natural Disaster

- **Natural Hazards** are elements of circumstances in the Natural environment that have the potential to cause harm to people or property or both.
- These may be swift or permanent aspects of the respective environmental settings like currents in the oceans, steep slope and unstable structural features in the Himalayas or extreme climatic conditions in deserts or glaciated areas.
- **Risk** is defined as the probability that exposure to a hazard will lead to a negative consequence, or more simply, a hazard poses no risk if there is no exposure to that hazard.
- **Natural Disaster** is an event of nature, which causes sudden disruption to the normal life of a society and causes damage to property and lives, to such an extent that normal social and economic mechanisms available to the society are inadequate to restore normalcy

Natural Disasters & Hazards in India

India is vast and diverse in terms of its physical and socio-cultural attributes. Its vastness in terms of natural attributes combined with its prolonged colonial past, continuing various forms of social discriminations and also equally large population have enhanced its vulnerability to natural disasters.

Major Natural Disasters in India

1. Droughts

The term 'drought' is applied to an extended period when there is a shortage of water availability due to inadequate precipitation, excessive rate of evaporation and over-utilization of water from the reservoirs and other storages, including the ground water.

- Drought has been defined differently by different geographers. A long, continuous period of dry weather is known as drought. The Meteorological Department of India defined drought as a period of at least 22 consecutive days recording less than 0.25 cm of rainfall
- This definition however, does not apply to the whole of India. In areas like Mawsynram and Cherrapunji (1187 cm) even one week recording less than 0.25 mm may be considered as a drought period.
- In India drought is often associated with the **failure of monsoon, especially in the years of El**-Nino like that of 1982, 1998, and 2009. In a drought year, the vegetation, crops, and surface and underground water tables are adversely affected.
- An agricultural drought is a period of four consecutive weeks with half or less than half of the normal rainfall or with a weekly rainfall of **5 cm or less during the period from mid-May to mid-October, when about 80 per cent of country's sown area is under kharif crops.** On an average, one in every five years is a drought year in India, while in western Rajasthan every two out of five years are drought years.

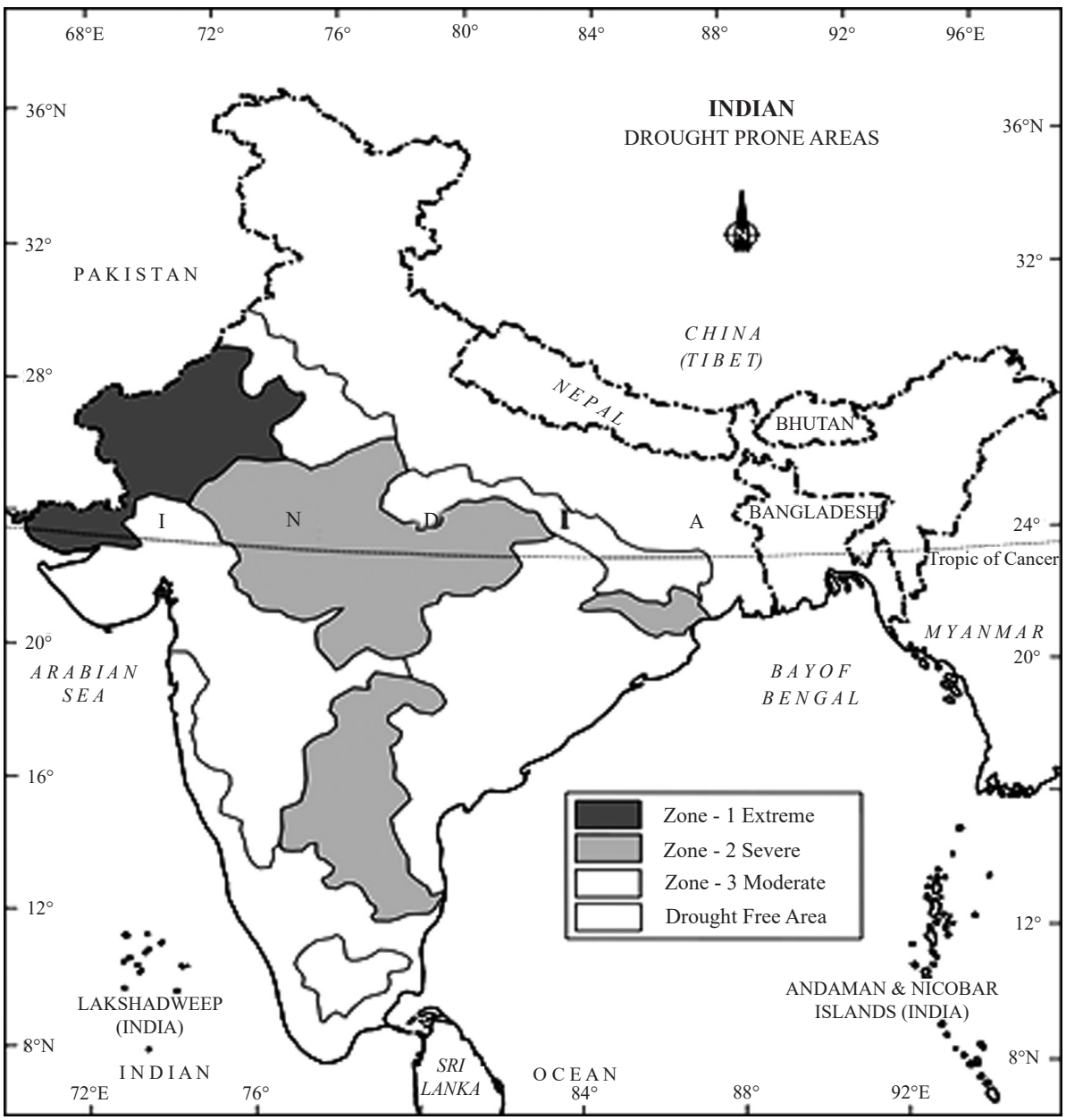
New definition of Drought according to IMD (India Meteorological Department)

If India's monsoon rainfall were to dip below 10 per cent of the normal and span between **20 and 40 per cent** of the country's area, it would be called a **"deficient"** year instead of an "All India Drought Year" as the IMD's older manuals would say. A more severe instance, where the deficit **exceeds 40 per cent** and would have been called an "All India Severe Drought Year," will now be a "Large Deficient Year".

Updated Nomenclature		
New Terminology	**Old Terminology**	
Normal	**Normal**	Percentage departure of realized rainfall is within ± 10% of the Long Period Average
Below Normal	**Below Normal**	Percentage departure of realized rainfall is >10% of the Long Period Average
above Normal	**Above Normal**	Percentage departure of realized rainfall is >10% of the Long Period Avergae
Deficient Yeay	**All India**	When the rainfall deficiency is more than 10% and 20-40% area of the country is under drought conditions
Large Deficient Year	**All India Servere Drought Year**	When the rainfall deficiency is more than 10% and when the spatial coverage of drought is more than 40%

Drought Prone Areas in India

On the basis of severity of droughts, India can be divided into the following regions:



UNIT-II

RESOURCES OF INDIA

Resource is defined as everything available in our environment which can be used to satisfy our needs, provided, it is technologically accessible, economically feasible and culturally acceptable. Resources are vital for human survival, improving quality of life and taking a country to shores of development.

The resources available in India can be classified as:

I. Renewable and Non-renewable Resources

(a) Renewable Resources

- Renewable resources are the ones that are consistently available regardless of their use. They can be fairly recovered or replaced after utilization. Examples include vegetation, water, and air. Animals can also be categorized as renewable resources because they can be reared and bred to reproduce offspring to substitute the older animals.
- As much as these resources are renewable, it may take tens to hundreds of years to replace them. The renewable raw materials that come from living things namely animals and trees are termed as organic renewable resources while those that come from non-living things such as sun, water and wind are termed as inorganic renewable resources.

(b) Non-renewable Resources

- Non-renewable resources are the ones that cannot simply be substituted or recovered once they have been utilized or destroyed. Examples of such natural resources include fossil fuels and minerals.
- Minerals are categorized as non-renewable because, even though they take shape naturally through the rock cycle, their formation periods take thousands of years.
- Some animals mostly the endangered species are similarly regarded as non-renewable because they are at the verge of extinction. It brings about the many reasons the endangered species have to be protected by all means.
- The non-renewable materials that come from living things such as fossil fuels are known as organic non-renewable resources while those that come from non-living things such as rocks and soil are referred to as inorganic non-renewable resources.

II. Biotic and Abiotic Resources

(a) **Biotic Resources:** The Biotic resources are the ones that come from the ecosphere (organic and living materials). Forests and forest products, crops, birds, wildlife, fishes and other marine lives are the examples of biotic resources. These resources reproduce and regenerate themselves, hence, are renewable. Fossil fuels such as petroleum, oil, and coal are also included in this grouping because they are generated from decayed organic matter but they are non-renewable.

(b) **Abiotic Resources:** The abiotic resources are the ones that come from non-organic and non-living materials. Examples of abiotic resources are water, land, air and heavy metals like iron, copper, silver, gold, etc. They are exhaustible and non-renewable as they cannot be regenerated or reproduced.

III. Stock Resources

- Stock resources are those that are present in the environment but the necessary expertise or technology to have them exploited. Hydrogen is an example of a stock natural resource.

India has enormous diversity in the availability of resources. There are regions which are rich in certain types of resources but are deficient in some other resources. There are some regions which can be considered self-sufficient in terms of the availability of resources and there are some regions which have acute shortage of some vital resources. Thus, proper planning can ensure judicious use of resources.

01 Chapter

NATURAL VEGETATION & WILDLIFE OF INDIA

India has a wide variety of flora and fauna which needs to be preserved and conserved. This chapter describes natural vegetation - forest types and their distribution in India; status of forests in India and policies related to forests in India. It also describes Wildlife conservation in India via national parks, wildlife sanctuaries, tiger reserves, and biosphere reserves.

India, the seventh largest country in the world by geographical area (constitutes 2.4% of the total geographical area of the world) with varied physiographic divisions, climatic regimes, and ecological habitats - exhibits a rich floral and faunal diversity.

Types and Distribution of Forest and Wildlife Resources

- In India, much of its forest and wildlife resources are either owned or managed by the government through the Forest Department or other government departments.
- These are classified under the following categories:

  (i) **Reserved Forests:** More than half of the total forest land has been declared reserved forests. Reserved forests are regarded as the most valuable as far as the conservation of forest and wildlife resources are concerned. Jammu and Kashmir, Andhra Pradesh, Uttarakhand, Kerala, Tamil Nadu, West Bengal, and Maharashtra have large percentages of reserved forests of its total forest area.

  (ii) **Protected Forests:** Almost one-third of the total forest area is protected forest, as declared by the Forest Department. This forest lands are protected from any further depletion. Bihar, Haryana, Punjab, Himachal Pradesh, Odisha and Rajasthan have a bulk of it under protected forests.

  (iii) **Unclassed Forests:** These are other forests and wastelands belonging to both government and private individuals and communities. All North-eastern states and parts of Gujarat have a very high percentage of their forests as unclassed forests managed by local communities.
- Reserved and protected forests are also referred to as permanent forest estates maintained for the purpose of producing timber and other forest produce, and for protective reasons.
  - Madhya Pradesh has the largest area under permanent forests, constituting 75 per cent of its total forest area.

Natural Vegetation of India

Natural vegetation refers to a plant community that has been left undisturbed over a long time, so as to allow its individual species to adjust themselves to climate and soil conditions as fully as possible.

- India is a land of great variety of natural vegetation. Depending upon the variations in the climate and the soil, the vegetation of India changes from one region to another.
- Himalayan heights are marked with temperate vegetation; the Western Ghats and the Andaman Nicobar Islands have tropical rain forests, the deltaic regions have tropical forests and mangroves; the desert and semi desert areas of Rajasthan are known for cactii, a wide variety of bushes and thorny vegetation.

Forest as a Concept

The forest is a complex ecosystem consisting mainly of trees that buffer the earth and support a myriad of life forms. The trees help create a special environment which, in turn, affects the kinds of animals and plants that can exist in the forest. Trees are an important component of the environment. They clean the air, cool it on hot days, conserve heat at night, and act as excellent sound absorbers.

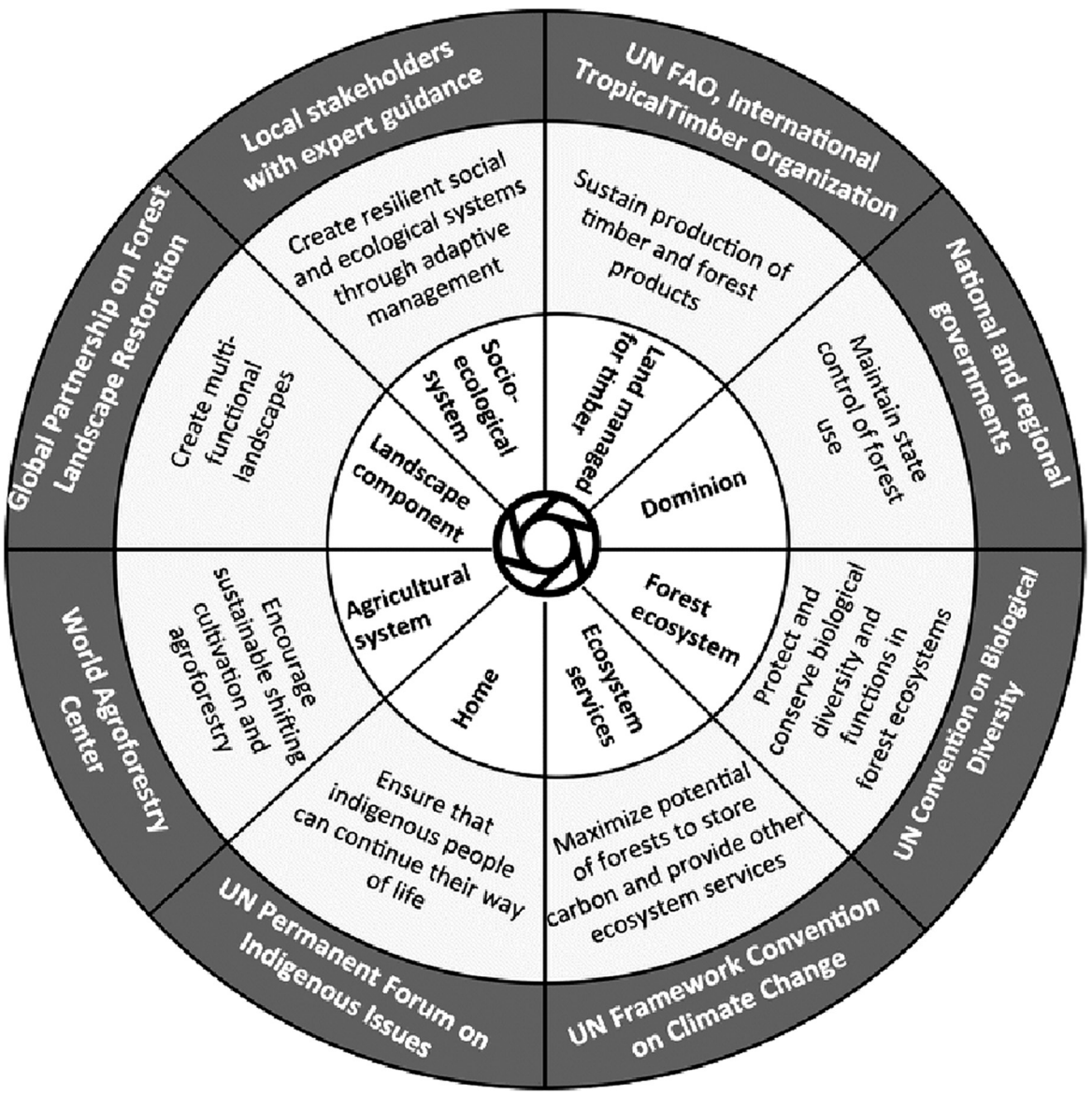
FAO Definition of a Forest

- The Food and Agriculture Organization (United Nations) defines it as "A forest is a land area of more than 0.5ha, with a tree canopy cover of more than 10%, which is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth is climatically suppressed, trees should be capable of reaching a height of 5m in situ, and of meeting the canopy cover requirement."

Forests are further subdivided into plantations and natural forests:

- **Natural Forests:** These are forests composed mainly of indigenous trees not deliberately planted.
- **Plantations:** These are forest stands established by planting or seeding, or both, in the process of afforestation or reforestation.

- **Forest Biome:** This reflects the ecological and physiognomic characteristics of the vegetation and broadly corresponds to climatic regions of the Earth.
- **Forest Type:** Within biomes, a forest type is a group of forest ecosystems of generally similar composition that can be readily differentiated from other such groups by their tree and undercanopy species composition, productivity and/or crown closure.
- **Forest Ecosystem:** A forest ecosystem can be defined at a range of scales. It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs are an integral part of many forest ecosystems.
- **Forest Biological Diversity:** Forest biological diversity means the variability among forest living organisms and the ecological processes of which they are part; this includes diversity in forests within species, between species and of ecosystems and landscapes.
- **Agro-forest:** An agro-forest is a complex of treed areas within an area that is broadly characterized as agricultural or as an agro-ecosystem.



Conceptualization of Forest

Figure: Different management objectives form the basis from which a forest is conceptualized and definitions are created. The inner circle shows how a forest can be viewed through different lenses, emanating from the different management objectives shown in the middle circle. Each objective provides a perspective from which specific definitions are created. The outermost circle describes institutions whose mission is associated with each management objective and forest definition.

02
Chapter

MINERAL RESOURCES OF INDIA

Minerals are valuable natural resources. They constitute the vital raw materials for many basic industries and are a major resource for development. India is endowed with a rich variety of mineral resources due to its varied geological structure. The wide availability of the minerals provides a base for the growth and development of the mining sector in India.

The country is endowed with huge mineral resources of fuel, metallic and non-metallic minerals including minor minerals. Since independence, there has been a pronounced growth in the mineral production both in terms of quantity and the value as well. India produces as many as 95 minerals, which includes 4 fuel, 10 metallic, 23 non-metallic, 3 atomic and 55 minor minerals (including building and other materials). The social and economic development of a nation depends on its capacity to utilize its natural resources and avoids its wasteful use to the extent possible. The most important characteristics of minerals which have bearing on our present and future well-being is that they are non-renewable resources. Hence, the need to conserve these resources and to recycle them cannot be over emphasized.

A mineral is a natural substance of organic or inorganic origin with definite chemical and physical properties.

- India is endowed with a rich variety of mineral resources due to its varied geological structure. Majority of the valuable minerals are products of pre-Palaeozoic age and are mainly associated with metamorphic and igneous rocks of the peninsular India.
- The Mining industry in India is a major economic activity which contributes significantly to the economy of India. The GDP contribution of the mining industry varies from 2.2% to 2.5% only but going by the GDP of the total industrial sector it contributes around 10% to 11%. Even mining done on small scale contributes 6% to the entire cost of mineral production.
- India has large reserves of Iron ore, Bauxite, Chromium, Manganese ore, Baryte, Rare earth and Mineral salts. India produces as many as 95 minerals, which includes 4 fuel, 10 metallic, 23 non-metallic, 3 atomic and 55 minor minerals (including building and other materials).

Distribution of Minerals in India

The distribution of mineral resources is uneven as occurrence of mineral resources is associated with certain types of geological formation.

- Coal deposits are mostly associated with Gondwana System
- Dharwar and Cuddapah Systems contain resources of major metallic minerals like copper, lead, zinc etc
- Major non-metallic minerals like limestone, dolomite, gypsum, calcium, sulphate etc are found in Cuddapah and Upper Vindhyan System
- Much of the peninsular region west of a line from Mangalore to Kanpur has very little mineral wealth. East of the line which covers the state of Karnataka, Andhra Pradesh, Orissa, Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar and West Bengal have the major reserve of metallic minerals like iron, bauxite, manganese, etc. and non-metallic minerals like coal, limestone, dolomite, gypsum, etc.
- Most of the metallic minerals in India occur in the peninsular plateau region in the old crystalline rocks.
- Over 97 per cent of coal reserves occur in the valleys of Damodar, Sone, Mahanadi and Godavari.
- Petroleum reserves are located in the sedimentary basins of Assam, Gujarat and Mumbai High i.e. off-shore region in the Arabian Sea.
- New reserves of minerals have been located in the Krishna-Godavari and Kaveri basins.
- Most of the major mineral resources occur to the east of a line linking Mangaluru and Kanpur.
- The vast alluvial plain tract of north India is devoid of minerals of economic use.
- India is poorly endowed with non-ferrous metallic minerals except bauxite.
- Minerals are generally concentrated in four broad belts in India. There may be some sporadic occurrences here and there in isolated pockets.

Mineral Belts of India

The North-Eastern Plateau Region

Region: This belt covers Chhotanagpur (Jharkhand), Odisha Plateau, West Bengal and parts of Chhattisgarh.

Minerals: This belt contains rich deposits of a variety of minerals, specially used for metallurgical industries.

- Prominent minerals that are large and widely distributed are iron ore, manganese, mica, bauxite, limestone, dolomite, etc.
- This region has also rich deposits coal, along the river valleys of Damodar, Mahanadi, and Son, etc.
- This region has also substantial amount deposit of copper, uranium, thorium, phosphate, etc.

The South-Western Plateau Region

Region: This belt extends over Karnataka, Goa and contiguous Tamil Nadu uplands and Kerala.

Minerals: This belt is rich in ferrous metals and bauxite. It also contains high grade iron ore, manganese and limestone.

- This belt lacks in coal deposits except lignite deposits found in Neyveli.
- This belt does not have as diversified mineral deposits as the north-eastern belt.
- Kerala has deposits of monazite and thorium and bauxite. Goa has iron ore deposits.

The North-Western Region

Region: This belt extends along Aravali in Rajasthan and part of Gujarat. The minerals in the region are associated with Dharwar system of rocks.

Minerals: Petroleum and Natural Gas are principal resources of this belt while deposits of other minerals are small and scattered.

- Copper, silver, lead and zinc have been major minerals.
- Rajasthan is rich in building stones i.e. sandstone, granite, marble. Gypsum and Fuller's earth deposits are also extensive.
- Dolomite and limestone provide raw materials for cement industry. Gujarat is known for its petroleum deposits.
- Gujarat and Rajasthan both have rich sources of salt.

Himalayan Belt

Region: This belt extends from Jammu & Kashmir, Ladakh, Himachal Pradesh, Uttarakhand and north-eastern states.

Minerals: The Himalayan belt is another mineral belt where copper, lead, zinc, cobalt and tungsten are known to occur. They occur on both the eastern and western parts.

- Assam valley has mineral oil deposits. Besides this oil resources are also found in off-shore-areas near Mumbai Coast (Mumbai High)

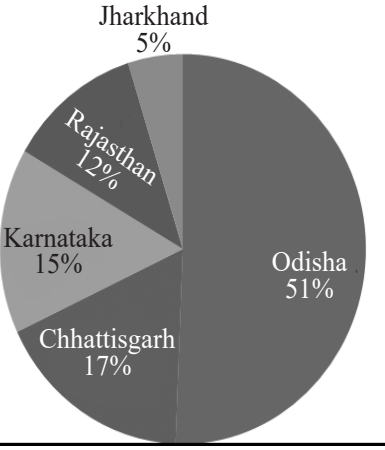
The United Nations Framework Classification (UNFC) for fossil energy and mineral reserves and resources prescribes a standard mineral classification based on three fundamental criteria, that is, economic viability, feasibility assessment and also geological assessment.

Status of Mineral Production in India

During 2021-22, mineral production was reported from 21 States/Union Territories of which the bulk of value of mineral production (excluding fuel and atomic minerals, and minor minerals) of about 88.7% was confined to 4 States.

- Odisha is in leading position, in terms of estimated value of mineral production in the country and had the share of 47.2% in the national output.
- Next in order was Chhattisgarh with a share of 16.2% followed by Karnataka (14.31%), Rajasthan (11%) and Jharkhand (4.5%) in the total value of mineral production.

Share of States in Value of Mineral Production 2020-21 (Estimated) (Excluding Atomic & Fuel Minerals)



- State-wise analysis revealed that during 2021-22, the value of mineral production (excluding fuel & atomic minerals) has shown a mixed trend as compared to that in the previous year.
- The States which have indicated major increase in the value of mineral production are Orissa (93%), Jharkhand (87%), Karnataka (65%) etc.
- However, some of the principal mineral producing states recorded decrease in value of mineral production (excluding fuel & atomic minerals) and those include Tamil Nadu (-0.85%), Kerala (-2.31%), Himachal Pradesh (-5.45%), etc.
- India's ranking in 2019 in world production was 2nd in Steel (crude/liquid), 3rd in aluminium (primary) & Chromite; 4th in iron ore, lead (refined) & Zinc slabs; 5th in Bauxite, 7th in Manganese ore, 13th in copper (refined), 16th in apatite & rock phosphate and 17th in Magnesite.

Highest Peak of States in India			
Peak	**Range/ Region**	**State**	**Height**
Arma Konda	Eastern Ghats	Andhra Pradesh	1680 m
Kangto	Eastern Himalaya	Arunachal Pradesh	7090 m
Someshwar Fort	West Champaran District	Bihar	880 m
Bailadila Range	Dantewada District	Chhattisgarh	1276 m
Sosogad	Western Ghats	Goa	1022 m
Girnar	Junagadh District	Gujarat	1145 m
Karoh Peak	Morni Hills	Haryana	1499 m
Reo Purgyil	Western Himalaya	Himachal Pradesh	6816 m
K2	Karakoram	Jammu and Kashmir	8611 m
Parasnath	Parasnath Hills	Jharkhand	1366 m
Mullayanagiri	Western Ghats	Karnataka	1925 m
Anamudi	Western Ghats	Kerala	2695 m
Dhupgarh	Satpura	Madhya Pradesh	1350 m
Kalsubai	Western Ghats	Maharashtra	1646 m
Mount Iso	Senapati District	Manipur	2994 m
Shillong Peak	Khasi Hills	Meghalaya	1965 m
Phawngpui	Saiha District	Mizoram	2165 m
Mount Saramati	Naga Hills	Nagaland	3841 m
Deomali	Eastern Ghats	Odisha	1672 m
Unnamed point on the Naina Devi	Rupnagar District	Punjab	1000 m
Guru Shikhar	Aravali	Rajasthan	1722 m
Kanchenjunga	Eastern Himalaya	Sikkim	8598 m
Doddabetta	Nilgiri Hills	Tamil Nadu	2636 m
Laxmidevipalli	Deccan Plateau	Telangana	670 m
Betalongchhip	Jampui Hills	Tripura	1097 m
Amsot Peak	Shivalik Hills	Uttar Pradesh	957 m
Nanda Devi	Garhwal Himalaya	Uttarakhand	7816 m
Sandakphu	Eastern Himalaya	West Bengal	3636 m

Major Reservoirs in India		
Reservoir	**State**	**River**
Dindi Reservoir	Telangana	Krishna River
Lower Manair Reservoir	Telangana	Manair River
Tatipudi Reservoir Project	Andhra Pradesh	Gosthani River
Gandipalem Reservoir	Andhra Pradesh	Manneru River
Himayat Sagar Reservoir	Telangana	Osman Sagar
Shriram Sagar Reservoir	Telangana	Godavari River
Gobind Sagar Reservoir	Himachal Pradesh	Sutlej River
Maharana Pratap Sagar Reservoir	Himachal Pradesh	Pong Dam Lake
Ghataprabha Reservoir	Karnataka	Ghataprabha River
Hemavathi Reservoir	Karnataka	Hemavati River
Tawa Reservoir	Madhya Pradesh	Tawa River
Balimela Reservoir	Odisha	Sileru River
Aliyar Reservoir	Tamil Nadu	Aliyar River
Chittar Reservoir	Tamil Nadu	Chittar River
Krishnagiri Reservoir	Tamil Nadu	Thenpennai River
Manimuthar Reservoir	Tamil Nadu	Tamirabarani River
Pechiparai Reservoir	Tamil Nadu	Kodayar River
Shoolagiri Chinnar Reservoir	Tamil Nadu	Chinnar River
Thunakadavu Reservoir	Tamil Nadu	Thunacadavu River
Varattu Pallam Reservoir	Tamil Nadu	Kaveri River
Vidur Reservoir	Tamil Nadu	Sankaraparani River
Amaravathi Reservoir	Tamil Nadu	Amaravathi River
Gundar Reservoir	Tamil Nadu	Berijam Lake
Kullursandai Reservoir	Tamil Nadu	Arjuna Nadi
Pambar Reservoir	Tamil Nadu	Pambar River
Periyar Reservoir	Tamil Nadu	Periyar River
Stanley Reservoir	Tamil Nadu	Kaveri River
Uppar Reservoir	Tamil Nadu	Uppar River
Vattamalaikarai Odai Reservoir	Tamil Nadu	Odai River
Willingdon Reservoir	Tamil Nadu	Periya Odai River
Bhavanisagar Reservoir	Tamil Nadu	Bhavani River
Kodaganar Reservoir	Tamil Nadu	Kodagananar River
Manimukthanadhi Reservoir	Tamil Nadu	Krishna River
Parambikulam Reservoir	Tamil Nadu	Parambikulam River
Sholayar Reservoir	Tamil Nadu	Chalakkud River
Thirumurthi Reservoir	Tamil Nadu	Parmabikulam and Aliyar River
Varadamanadhi Reservoir	Tamil Nadu	Aliyar River
Vembakottai Reservoir	Tamil Nadu	Vaippar River
Manjalar Reservoir	Tamil Nadu	Manjalar River
Salal Project	Jammu and Kashmir	Chenab River
Chutak Hydroelectric Project	Jammu and Kashmir	Suru River
Indirasagar Project	Madhya Pradesh	Narmada River
Narmada Dam Project	Madhya Pradesh	Narmada River
Rihand Project	Uttar Pradesh	Rihand River and Son River