Indian Geography

Contents

1. STRUCTURE AND RELIEF OF HIMALAYAS

The Himalayas constitute a folded mountain complex and formed due to the closure of the Tethys ocean basin upon the convergence of the Indian and the Eurasian plates. The Himalayas run for a length of 2400 km and are widest in the west. At both of their extremeties in the northwest and the northeast, they show sharp bends which leads to an abrupt change in their direction. These bends are called the *syntaxial bends*. Since the relief and structural features of the Himalayas show a zonal arrangement, they are briefly discussed in terms of the respective zones.

A) The Siwalik Zone : These constitute the outermst belt and have an average elevation of 1500 metres. These are a system of continuous ranges. They are separated from the Lesser Himalayas in the north by the Main Boundary Fault, a group of factures. The siwaliks are called Jammu hills in J & K and Daffla, Miri Mishmi and Abhor hills in the northeast.

B) The Lesser Himalayas: Also called as Himachals, they show an average elevation of 3000 metres. Unlike the Siwaliks, they occur in the form of a series of discontinuous ranges. The Pir Panjal, the Dhauladhar and the Mussoorie Range are part of the Himachals. Kulu, Kangra Lahul and spiti are prominent valleys within the Himachals. Along the junction of the Himachals and Greater Himalayas, valleys filled with sediments, called the Doons occur.

c) **The Greater Himalayas :** These are also called the Himadris and are separated from the Himachals by the Main Central Thrust. Their average elevation is 6100 metres. The topography of the Himadris is very rugged and they boast of 14 of the 28 tallest peaks of the world. The four prominent peaks of the Greater Himalayas are Mt. Everest, Everest South Peak, Kanchenjunga-I and Lhotse-I. The Greater Himalayas are cut by some prominent passes like the Zojila pass (Kashmir), the Shipki pass (Himachal) and the Liphu Lekh Pass (Uttarakhand). Some very large glaciers are present within the Greater Himalayas like Zemu, Gangotri, Kanchenjunga and others.

D) **The Trans-Himalayas** : These lie north of te Greater Himalayas and are made up of the Karakoram, Ladakh and Zaskar Ranges, from north to south. *The Karokorams have the world's largest non-polar glacier i.e., the Siachen*. The Ladakh Ranges have the highest peak of India - the Ladakh Plateau. Towards the north, the Transe-Himalayas have the *Indus-Tsangpo Suture Zone* - where the Indian plate and the Euraslan plate are joined.

2. THE ORIGIN OF THE HIMALAYAS

The Himalayas represent a folded mountain belt. Folded mountain belts form due to compression of the earth's crust by the movement of lithospheric plates. According to the theory of *plate tectonics*, folded mountain belts form when two lithospheric plates made up of continental masses progressively converge upon each other and close an intervening ocean basin.

The Himalayas formed as a result of the convergence of the Indian plate with the Eurasian plate, thereby closing the Tethy's ocean between them. The Tethys ocean is postulated to be present between the Indian plate and the Eurasian plate. As the Indian plate moved northwards, the Tethy's Ocean began to be squeezed between the northward moving Indian plate and the Eurasian plate (lying north of the Tethys ocean). According to geographers, the Indian plate collided with the Eurasian plate around five times. Each of these collisions led to the progressive evolution of the Himalayan folded mountain complex. The collisions squeezed up the sediments lying on the floor of the Tethys as well as the oceanic crust of the Tethys. In the final phases of collision, even the leading portions of the Indian landmass got fractured and these sliced off portions were thrust up. The Greater Himalayas are said to represent a part of the Indian landmass. The various structural features within the Himalayas like the Main Central Thrust (which separates the Greater Himalayas from the Lesser Himalayas), the Main Boundary Fault (which separates the Lesser Himalayas from the Siwaliks) and the Indus Suture Zone are due to these collisions. The outermost belt of the Himalayas i.e., the Siwalik Ranges are said to have formed in the last phase of collision. The Indian plate is believed to be still

moving north and thrusting against the Eurasian plate and hence leading to the continued rise of the Himalayas.

3. IMPACT OF HIMALAYAS ON INDIA's CLIMATE

The Himalayas are an important controlling factor in the climate of India. The Himalayas are responsible for splitting rapid upper airflows called jet streams into two branches. These jet streams influence the onset of monsoons over north Indian plains. *Secondly, though half of India lies in the tropics, the entire country has a tropical climate because of the Himalayas*. This is because of two effects of Himalayas. 1. The Himalayas insulate India from cold winds originating in Siberia / Manchuria by blocking them. These cold winds in winter could have brought very cold conditions to India i.e. temperate climatic conditions. 2. The landmass of India heats up in summer and this leads to northerly shift of the equator. But the excess heating up of the landmass of India is because of Himalayas blocking the entry of cold winds coming from the north. Both these factors associated with the Himalayas gives to India its tropical climate with a cold dry and hot wet season.

4. IMPORTANCE OF HIMALAYAS TO INDIA

The Himalayas are very important to India in terms of the resources they offer to India, their role in India's climate, and their strategic functions due to their location along the frontier.

A) **Resources From Himalayas**: The Himalayas are the birthplace for the Indus, Ganga and the Brahmaputa systems. These rivers have been responsible for the development of the fertile Indo-Gangetic plains which form the core agricultural regions of India. These rivers also provide water for agriculture, irrigation and municipal needs. In addition, the Himalayas have rich reserves of subtropical and temperate timber species. The coniferrous vegetation of the Himalayas is a source of rich reserves of softwood timber which finds use in a variety of industries. The Siwalik ranges of the Himalayas are rich in mineral resources like gypsum, limestone and good quality phosphate deposits.

B) **Ecological Importance**: The Himalayas are extremely rich in biodiversity and the Himalayan region of northeast India is considered to be one of the 12 major biodiversity rich zones of the world. Himalayas play a very prominant role in the ecology of the subcontinent. They maintain the regional hydrological balance and also the regional ecological balance through their rich forests. The Himalayas also influence the climate of India profoundly like for e.g., they prevent the northward migration of the monsoons away from India and also prevent cold Siberian winds from blowing over India in winter.

C) The Himalayas also offer exotic sites for recreation and tourism. The Himachal Ranges boast of a large number hill stations which are major tourist destinations in summer (like Ranikhet, Mussoorie, Dalhousie Point, Simla, Darjeeling and others).

D) The Himalayas also have a strategic value because they provide a natural frontier to India which forms a natural defensive border for India in the north and the northeast.

5. THE GREAT PLAINS OF INDIA

The Great Plains of India include the Indus Plains, the Ganga Plains and the Brahmaputra plains. These cover an area of 7.5 lakh sq kms. Except the Thar Plains and the Rann of Kutch, the Great plains are a result of deposition of alluvial sediments by the Indus, Ganga and the Brahmaputra systems. The Great Plains are widest in the west (in the Punjab - Rajasthan stretch) and narrow down towards the east. The Delhi Ridge of the Aravalli Ranges is the Indo-Gangetic Divide since it divides the Indus from the Brahmaputra plains. The different regions within the Great Plains are :

1. **Punjab-Haryana Plains** : These are made up of the floodplains and alluvial plains of the Ravi, Beas and Sutlej. They merge with the plains of Rajasthan in the south. Within the Punjab-Haryana plains, the Khadar plains (i.e., plains with newer alluvium) of Punjab are called *Bets* while *Chos* are parts of Punjab Plains with gullies and ravines.

2. **The Rajasthan Plains** : These include the Thar plains. The portion of Thar which is very arid is called Marusthali plain while *Bagar* constitute the *steppe land* immediately west of Aravallis. The narrow stretch of fertile plains near the foothills of the Aravallis are called *Rohi* plains. The Thar plains and portions of the Rann of Kutch are not due to deposition of river alluvium. Thee were originally part of the Arabian sea floor and were uplifted in the pleistocene epoch. Initially, this newly uplifted sea floor was marshy / swampy but later changed into a desert as it came under the influence of the sub-tropical high pressure belt and also because of the fact that the Aravallis do not obstruct the monsoon winds to induce rainfall in this region. Within the Thar plains and the Rajasthan Bagar, temporary saline lakes are called Ranns. The most important river draining the Thar plains is Luni.

3. **The Rann of Kutch :** The Great Rann represents a very large tidal marsh. Both the Great Rann and Little Rann represent the filling up of an arm of the Arabian sea by sand and silt deposits by wave and current action. Originally, the region which today makes up the Great Rann was made up of a few islands within an arm of the Arabian sea. These islands were joined to the Indian landmass by narrow strips of sediments. As waves and currents depsoited sediments, these islands grew and got joined to the Indian landmass completely. The Great Rann develops into a swampy region during the summer monsoon of India.

4. **The Ganga Plains** : These costitute the largest part of the Great plains by *area*. The Ganga plains include the upper Ganga, Middle Ganga and Lower Ganga Plains. The Upper Ganga plains lie between river Yamuna and Allahabad and include the Ganga-Yamuna doab, the Rohihkhand plains and Avadh Plains. In the northern parts (today lying primarily in Uttaranchal), the upper Ganga plains are made up of the *Bhabhar* and the *Terai* zones. The Bhabhar is a piedmont plain made up of coarse sediments. South of the Bhabhar lies the *Terai* which is a marshy/ swampy lowland. The Terai plains are made up of finer sediments. South of the Terai lie the Bangar and the Khadar plains. The *Bangar* is made up of older alluvial deposits and occurs on relatively higher land while the *Khadar* is made up of new alluvial and occurs as lowlands. The Yamuna, Ghaghara and the Ramganga are the most important rivers draining the upper Ganga Plains. The *Middle Ganga Plains* cover portions of eastern U.P. and northern Bihar. They are made up of the Ganga-Ghaghara doab, the

Mithila plains and the Kosi plains in the north and Magadh and Anga plains in the south. In their northern fringes, the Middle Ganga plains of Bihar have a long line of marshes called *Caur*. The Lower Ganga plains principally lie in W. Bengal and are mostly made up of the Ganga delta. The lower Ganga plains are divided into Barind Plains (in northern parts of W. Bengal), the Teesta plains (the Central to northern parts of W. Bengal), the Rarh Plains (in western parts of southern W. Bengal) and the Sunderbans delta.

The Brahmaputra Plains : These constitute the upper Brahmaputra plains lying within Assam. These are the floodplains along the upper course of Brahmaputra. They slope to the east and south and show a series of river terraces (i.e., a series of floodplains occurring at different elevations).

6. THE WEST COASTAL AND EAST COASTAL PLAINS

The West Coastal Plains : The west coastal plains extend for a length of 1400 kms between Diu and Kanyakumari and occur between 8^0 North to 20^0 north latitudes. The average width of the west coastal plains is 25-50 km. They are widest in the Konkan stretch. The west coastal plains off Maharashtra and Gujarat are the Konkan plains. The Sahyadris form steep west facing scarps along the Konkan coast. The Konkan coast is a submerged coast as shown by submerged forests and drowned rivers. The west coast off Karnataka is the Kanara coast. It is also a submerged coast. The west coastal plains become narrowest in the Kanara stretch. The west coast off Kerala is the Malabar coast. Three are a series of sand dunes in the Malabar coastal plains, locally called Teris. The sand dunes have given birth to a large number of backwaters called Kayals. Unlike the Konkan and the Kanara coasts which are submerged, the Malabar coast is an emerged coast. In general, the west coastal plains lack deltas.

The East coastal plains : These stretch for a length of 1100 kms between 8^0 north and 21^0 north. In general, the east coastal plains are referred to as the Coromandel coast. Again, the entire east coast is an emerged coast. The east coastal plains off Orissa are

called the Utkal plains. The Utkal plains include lake Chilka, the largest saline lake of India. The east coastal plains off Andhra are called the Andhra plains. The East Coastal plains become widest in the Andhra plains. The Andhra plains contain lake Kolleru, the 2nd largest freshwater lake of India. The East coastal plains off Tamil Nadu are called the Madras coastal plains which include lake Pulicat. In general, compared to the west coastal plains, the east coastal plains are wider and are characterised by the presence of large deltas of Mahanadi, the Krishna-Godavari system and Cauvery.

7. DECCAN TRAPS

The phrase Deccan Trap refers to the structure shown by the Deccan plateau. The stepped surface of the Deccan plateau is called the Trap structure and hence the name Deccan Trap. The stepped appearance is a result of the solidification of lava flows after flowing for variable distances. The Deccan plateau is made up of solidified lava flows. The Deccan plateau is the largest plateau of India covering almost entire Maharashtra, Malwa and northern parts of Mysore and Telangana plateaus. The Kathiawar peninsula is also part of the Deccan plateau. The Sahyadris or the northern Western Ghats are edges of the Deccan plateau. The Deccan plateau is structurally composed of hundreds of individual layers of solidified lavas. The plateau slopes towards the east and attains its maximum thickness near Bombay. The lavas were poured out from linear fissures and hence deposited as layers. The Deccan plateau is covered by black soils which have been derived from the basaltic rocks that make up the plateau. There are a large number of ranges within the Deccan Plateau like Balaghat Range, Ajanta Range etc. The northern W. Ghats, which are part of the Deccan plateau are broken by the Bhor Ghat and the Thal Ghat passes. The highest peak of Sahyadris is Vavulmara. The prominent peaks of Sahyadris are Mahabaleshwar, Salher and Kalsubai.

8. THE CHOTANAGPUR PLATEAU

The Chotanagpur plateau includes Jharkhand and adjacent portions of W. Bengal, Orissa and Chattisgarh. It is between Rajmahal hills in the east and Maikala Ranges in the west. It is a continental plateau and is made up of very old igneous and metamorphic rocks that make up the peninsular landmass. The Chotanagpur plateau includes a series of smaller plateau-like features which are called *patlands*. These patlands are the Ranchi plateau, the Hazaribagh plateau, the Koderma plateau and others. The highest hills of the Chotanagpur plateau are the Parasavanath hills. Most of the plateau is covered with red soils which have been developed by the granitic rocks below. The Damodar and Suvarnarekha are the principal rivers of the Chotanagpur plateau. The plateau boasts of rich deciduous forests of sal and teak and is the richest mineralised zone for metallic deposits of India. It also includes some of the richest coalfields of India.

9. WESTERN GHATS & EASTERN GHATS

The Western Ghats : The Western Ghats constitute a system of narrow hill ranges extending for a length of 1600 kms between Diu and Kanyakumari. They lie close to the coast and hence the west coastal plain is only about 50 kms wide (the width increases towards the south). The Western Ghats north of Goa represent the plateau edges of the Deccan plateau and show the Ghat or *Trap* appearance. They are therefore made up of volcanic rocks. The Southern Western Ghats are made up of rounded hills of old igneous and metamorphic rocks and occur as the Nilgiri, Annamalai and Cardomom hills. These hills represent residual hills of the peninsular plateau. Unlike the northern W. Ghats, the Southern Western Ghats show a gentle relief. The Northern Western Ghats have some prominent peaks like Mahabaleshwar and Vavulmara. The Bhor Ghat and Thal Ghat passes are prominent breaks in the northern W. Ghats.

The Southern Western Ghats have some prominent peaks like Doddabetta (in Ooty hills of Nilgiris), Anaimudi Peak (in Annamalai hills), Brahmagiri and Kudremukh. The prominent breaks in the

Southern W. Ghats are Palghat Pass (between Annamalai and Nilgiri Hills) and the Shencottah Pass (between Annamalai and Cardomom hills).

The Eastern Ghats : The represent residual mountains and occur in the form of a series of discontinuous ranges / hills. The Eastern Ghats are made up of the very old igneous and metamorphic rocks that make up the peninsular plateau. Unlike the western ghats, the eastern ghats occur much in the interior and hence the east coastal plains are more wide. The E. Ghats extend for a length of 1100 kms between south of Chilka lake and Kanyakumari with an average elevation of 600 meters. The Eastern Ghats in A.P. occur as Nallamala ranges, in Tamil Nadu, they occur as Palani, Shevaroy and Javadi hills and in Orissa, they are called the Orissa hills. The tallest peak of the Eastern Ghats i.e., Mahendragiri peak occurs in the Eastern Ghats of Orissa. The Eastern and Western Ghats join in the Nilgiri Ranges.

10. HIMALAYAN AND PENINSULAR RIVERS

Himalayan rivers include the drainage basins of the Indus, Ganga and Brahmaputra. The Himalayan rivers originate in the snowfields and glaciers of the Himalayan ranges. They are perennial and have large basins and catchment areas. The Himalayan rivers are antecedent and are in their youthful stage and hence are actively eroding their valleys. Since they descend from great heights of the Himalayas, they create excellent heads for the generation of hydropower. These rivers have an extensive network of tributaries and show meandering courses in the Indo-Gangetic plains. They also shift their courses in the plains.

The peninsular rivers are born from natural springs and lakes of the hilly regions of peninsular India. Since they do not have sources in glacial fields and snow fields they are non-perennial. These rives have small basins and catchment areas and have cut their courses in hard rock strata. Their shallow and they have fewer tributaries. They show a superposed and a consequent drainage. The peninsular rivers are in their old age and hence their valley

floors are almost at sea level. They descend from smaller heights and do not create many heads for hydropower generation. Only some of the peninsular rivers form deltas like Mahanadi, Godavari, and Cauvery.

11. THE MONSOONS OF INDIA

The monsoons are seasonal winds blowing over the Indian subcontinent. The monsoons comprise of the southwest or the summer monsoons blowing from June to September, the retreating monsoons blowing between September to December and the northeast monsoons blowing between December to February. The moonsoon winds show seasonal reversal of wind direction. The southwest monsoon is born due to the following factors.

1. **Shift in the Pressure belts of the world** : In the summer of the northern hemisphere, there is a global shift of pressure belts to the north. This leads to the northward migration of the Inter-Tropical Convergence Zone (i.e., the I.T.C.). As a result, the southeast trade winds, normally confined to the southern hemisphere, cross the equator (since they always blow towards the ITC) and approach the Indian landmass as southwesterly monsoon winds.

2. **The Monsoon Trough**: This is a well developed low pressure system stretching between Saudi Arabia and the coast of Orissa. This low pressure system which covers the northern Indian plains, is due to the intense summer heating of the landmasses of Asia and Arabia. The monsoon trough attracts the air from the Indian ocean as well as the southeast trade winds which have been modified into the southwesterly monsoons towards the northern plains. Thus the southwest or the summer monsoon is basically a modification of the southeast trade winds which have crossed the equator.

The Retreating Monsoons : The monsoon rains in summer cool the Indian landmass and hence air pressures over the northeern plains rise. However air pressure over the adjoining Indian Ocean is relatively low. This leads to the retreat of the monsoon winds which now blow from land to sea. The retreat begins on 1st

September in Rajasthan and is completed by 15th December. These monsoons bring some rain to parts of Rajasthan, the Andhra Coast and Tamil Nadu Coast.

The Northeast Monsoon: Beginning in December, the pressure belts of the world begin to shift southwards. As a result, the Indian landmass comes under the influence of the northeast trade winds which blow from northeast to southwest over India between December and February. These are called the northeast monsoons. They bring some rain to parts of the Tamil Nadu Coast and interior Kerala.

12. VARIABILITY OF RAINFALL IN INDIA

Around three fourths of the total annual rainfall in India is received during the summer monsoon season. Some regions of India receive rainfall during the retreating monsoon and northeast monsoon periods (like the Coromandel and Andhra coasts, interior Kerala and Tamil Nadu, parts of Punjab, Delhi, Haryana and Himachal Pradesh). Though the average monsoonal rainfall for India is anywhere between 88 cms to 100 cms, there is great spatial variability in the rainfall received in different parts of the country. The factors responsible for the spatial variability of rainfall in India are :

1. **Latitudinal Location** : Regions close to the Indian Ocean (including the Bay of Bengal and the Arabian sea) receive more rainfall since monsoon is an air current carrying moisture and hence the distant areas (like places in Jammu and Kashmir) far removed from the oceans receive lesser rainfall.

2. **Effect of Relief Features** : Spatial variability of rainfall is due to the profound effect of topography and relief. For example, Mumbai gets about 190 cms of rainfall during summer monsoon because of its windward location but Poona, which is just 160 kms away gets only 50 cms of rainfall because of its leeward location. Again, much of Rajasthan does not receive rainfall during the summer monsoon because the Aravalli Ranges are parallel to the southwest monsoon.

3. **Vagaries of the Monsoon** : Spatial variability of rainfall is also due to some characteristic of the monsoon winds themselves. These inherent characteristics include features such as late onset, early withdrawal and break monsoon conditions. For e.g., in some years, the monsoon does not advance according to the normal pattern and hence leads to variation in the amount of rainfall. For e.g., the monsoon current may reach the Punjab plains one week later than the normal onset date hence causing lesser rainfall. Similarly, the break monsoon conditions (i.e., the breaks in the spell of monsoonal rain) can cause variation in rainfall. In July and August, there are certain periods when monsoons become weak and rainfall ceases over the entire country outside the Himalayan region. This is known as the break in the monsoon.

4. **Role of Storms and other Weather Disturbances** : The east coast of India, the Middle and Lower Gangetic plains get heavy rainfall due to monsoon depressions which form in the Bay of Bengal between June and September. All these depressions enter the peninsular landmass along the deltas of Ganga, Mahanadi, Godavari and Krishna causing heavy rainfall. Cyclone activity in the Bay of Bengal in October and November also leads to heavy rainfall on the east coast. Weather disturbances originating in the Mediterranean (i.e., the Western Disturbances) bring rainfall to parts of Jammu and Kashmir, Himachal, Punjab, Haryana and Delhi in January and February.

13. WESTERN DISTURBANCES AFFECTING INDIA

Western Disturbances refer to the temperate cyclones that form in the Mid-latitudes and which in their course of travel to the east, reach the northern parts of the India. These cyclones originating in West Asia, the Mediterranean and sometimes even the Atlantic, reach the northern portions of India bringing winter rainfall to Punjab, Haryana, Chandigarh, Delhi, Himachal Pradesh and sometimes Rajasthan, and snowfall to Jammu and Kashmir. In the winter season, these cyclones move farthest to the south. By the time these western disturbances reach India, they are in the weakened stage and hence bring moderate rainfall/snowfall. Most of

the western disturbances that affect India occur in the cool season (the retreating monsoon season). In the northeast monsoon season, most of the temperate cyclones do not pass over the subcontinent. However, some secondary temperate cyclones which form over the Nile Basin and the Red Sea move northeast and enter India.

14. TROPICAL CYCLONES OF INDIA

The tropical weather disturbances affecting India develop in three different periods i.e., the Southwest Monsoon period, the Retreating Monsoon Period and the Northeast Monsoon period. The weather disturbances that develop in the southwest monsoon season are the monsoon depressions. These form in the northern part of the Bay of Bengal. The rainfall of Bengal and Orissa and that of the northern Indian plains is to a large extent, determined by the frequency and intensity of these monsoon depressions. The tropical cyclones that develop in the Bay of Bengal form towards the open part of the Bay i.e., in a lower latitudinal belt. Nearly 50% of the tropical cyclones that develop in the Bay of Bengal actually develop in southwest Pacific and move west to reach the Bay. The tropical cyclones that form in the Bay of Bengal are maximum in the retreating monsoon season (the cool season). Around 55% of the storms of Bay of Bengal affect the Indian coast. Many cyclones that strike the Indian coast below 15^0 north, move across the Peninsula and emerge into the Arabian sea. Here they reintensify into severe cyclones and strike Konkan, Gujarat and Malabar. Cyclonic activity in the Bay of Bengal is the least in the northeast monsoon season. These cyclones usually form in more southerly latitudes (i.e., between 5^0 to 10^0 North) and may strike the southern coast of Tamil Nadu. In general, it may be noted that more number of cyclones form in the Bay of Bengal than the Arabian sea. Of all the storms that develop in the Arabian sea, only 25% affect the Indian coast, with the rest moving west. It may also be noted that nearly 50% of the Arabian sea cyclones are storms of the Bay of Bengal i.e., they have developed out of the remnants of the Bay storms which have crossed over into the Arabian sea.

15. RAINFORESTS OF INDIA

Tropical rainforests of India have developed in areas receiving more than 100 cms of rainfall per year and where the yearly average temperature is between 25°C to 27° C. These regions have a short dry season. The tropical rainforests of India include:

1. **Tropical Evergreen Forests** - These have developed in regions with more than 250-300 cms of rainfall per year and constitute the typical rainforests. They are found in areas below a height of 900m on the windward slopes of W.Ghats, in Andaman and Nicobar and in Northeast India. The typical species are Rosewood, Ebony, Mahogony, Gurjan etc.

2. **The Tropical Semi-evergreen forests** - These have developed in regions getting rainfall between 250-200 cms per year. The forest is a mixture of evergreen and deciduous species. These occur in northern parts of W. Bengal, the Orissa Hills and parts of Andaman and Nicobar. Rosewood, Laurel are some species.

3. **Tropical moist deciduous forests -** These have developed in regions with 150-100 cms of rainfall. They occur in Northeast, eastern slopes of Himalayas and the Central plateaus.

4. **The Shola Forest** - This is a type of rainforest but is part of temperate broadleaf hill forest and is found in the Nilgiris.

16. VEGETATION OF HIMALAYAS

The Himalayan Vegetation shows vertical gradation of forest type due to vertical gradation in climate. In the eastern Himalayas, tropical evergreen and semi-evergreen forests occur upto 900 metrees. Between 900-1800 meters, the evergreen montanne forests with pine and oak dominate. Between 1800-2800 metres, the monsoon temperate forests of oak, chestnut and laurel are developed. Between 2800-4300 metres, the conifers with spruce, fir and other softwoods are developed. Above 4300 M, the alpine and arctic vegetation of grass and mosses and lichen are developed. The vegetation sequence in Western Himalayas is much the same except that the conifer zone starts at a much lower height.

17. SOILS OF INDIA

1. **Black Soils** : Derived from the basalts (the volcanic rocks) of the Deccan plateau. The black colour is due to the presence of titanium bearing iron and to a certain extent humus. Also called Regur soils, Black Cotton soils or Tropical Chernozem soils. The soils are **poor** in nitrogen, phosphorous but **rich** in humus, potassium, calcium, magnesium and lime. The soils are **fertile** because they contain water soluble salts and because they retain moisture. The **largest occurrence** of Black soils is in Maharashtra. They also occur in Malwa and Kathiawar. They soils of Bundhelkhand called **Mar** and those of lower Ganga basin called **Karail** are similar to black soils.

2. **Alluvial Soils** : The most dominant soils by volume. In the northern plains they show belts in the form of Bhabhar, Terai, Bangar and Khadar. They do not show any horizons and have a loamy texture. Poor in humus, nitrogen and phosphorous but rich in Potassium. Their fertility is due to **diversity of mineral species** within them and due to the rich subsurface water resources. **Usar soils are alluvial soils of Punjab with high concentration of sodium salts.**

3. **Red Soils :** These are made up of Red and Yellow soils. They have been developed from the very old **granitic** rocks of Peninsular India. They red colour is due to iron oxides. The yellow soils have a coating of **hydrated oxide of iron** which is yellow in colour. The Red soils are poor in nitrogen, phosphorous, humus and lime (calcium oxide) but are **rich** in iron and potassium. They red soils are the most widespread in Tamil Nadu and occur throughout peninsular India wherever the granitic rocks occur. They also occur in Shillong Plateau. In Telangana, the red soils are called **Chalkas**. The red soils are the **most widely** distributed soils of India.

4. **The Lateritic Soils** : These occur as **cappings** on hill tops/ plateau tops. They have developed due to intense chemical weathering of rocks (i.e., intense leaching) and hence have only iron and aluminium oxides (because every other element has been leached away). They show a **honey-comb** structure. They are very infertile. They are clayey and show a lumpy appearance. These soils are residual.

5. **The Desert Soils** : The desert soils of Rajasthan represent the sands of the continental shelf of the Arabian sea. They are light coloured and have a high percentage of water soluble salts. They are poor in nitrogen, humus and clay. They are rich in phosphorous, potassium, calcium and sodium. The desert soils of Thar are very rich in phosphates.

6. **Peaty and Organic Soils** : These have formed in situ under humid climate and poor drainage. These soils are acidic. Organic matter may make-up 40% to 50% of the soil. The peaty saline soils of **Kerala** are called **Kari**.

18. IRRIGATION

About 75% of the rainfall in India is by the southwest monsoons which bring rainfall for only three to four months in a year. It is also a fact that only 30% of the cultivated area receives 75 to 100 cm of annual rainfall. Hence around two-thirds of the cropped area needs irrigation to support agriculture. The need for irrigation in more specific terms is brought out by certain facts. These are a) about one-third of India's land area is drought-prone b) rainfall is unevenly distributed across different regions. c) Peninsular India's rivers are not only seasonal but also have uncertain flows during different periods d) Irrigation is necessary to increase productivity of dryland agricultural regions and e) Irrigation makes possible the application of modern inputs.

Irrigation potential of India is reasonably large due to the presence of perennial rivers in the northern plains, the rich reserves of underground water in some regions, the large volumes of water seasonally carried by the peninsular rivers and the abundant monsoon rainfall that India receives. In fact, many rivers of India carry large volumes of utilizable flows.

19. AGRICULTURAL SEASONS AND CROPPING PATTERN OF INDIA

Agricultural Seasons : The cropping pattern of India falls within three agricultural seasons- the kharif, the rabi and the zaid. Kharif season is agriculturally the most important because almost the entire arable land comes under crops. It starts with the onset of the southwest monsoon and continues till winter. Rice, maize, bajra, cotton, groundnut and some pulses crops dominate the kharif season. The rabi season starts in October or November and continues either till the end of winter or the beginning of summer in March. The rabi crops are mostly raised under irrigated conditions. The major crops are wheat, barley, jowar and some oilseeds like rapeseed mustard. Zaid is a short cropping season where crops are sown in summer and harvested in the rainy season. The important crops are fooder crops, fruits and vegetables and some rice, maize, groundnut and pulses.

Cropping Pattern : India's cropping pattern is dominated by foodcrops due to the huge population. The net sown area of India is 46% of the total land. The area under foodgrains is largest in UP followed by MP, Rajasthan and Maharashtra. The area under non-food crops is largest in Maharashtra followed by MP, AP and Gujarat. In the cropping pattern for food crops, rice dominates with around 24% of the gross cropped area devoted to it. The largest rice acreage is in U.P., W.Bengal, Bihar and M.P. Wheat is the dominant rabi food crop. The largest area under wheat is in U.P. followed by M.P., Punjab, and Rajasthan. The most important coarse cereals are jowar, bajra, maize and ragi and most of them are kharif. Jowar occupies the greatest area in coarse cereals and is a rabi crop. Most area under jowar is in Maharashtra. After jowar, bajra occupies the second largest area in coarse cereals. Rajasthan followed by Maharashtra have the largest areas under bajra.

Pulses account for 18% of India's cropped area and chick pea and pigeon pea account for half of pulses output. The leading growers of pulses are M.P., Maharashtra, Rajasthan and U.P. Oilseeds are raised in India as both kharif and rabi crops and oilseeds account for 13% of cropped area. Gujarat leads in Kharif oilseed output while U.P. leads in rabi oilseed output.

The most important cash crops dominating India's cropping pattern are cotton, sugarcane, jute, coffee and tea. Sugarcane is a kharif crop and the maximum area under cane is in U.P. India has the largest area under cotton and it is raised as a kharif crop.

Maharashtra has the largest area under cotton. India has the largest area under jute and is also the largest producer. The jute area is principally in W. Bengal. India is the largest producer of tea and the maximum area under tea plantation is in Assam. India is an important producer of coffee and nearly 75% of coffee area is in Karnataka.

20. CAUSES OF LOW AGRICULTURAL PRODUCTIVITY IN INDIA

Agricultural productivity is simply the output per unit area of land. Indian productivity is 2/3rd of world average productivity and about 60% of the productive potential in the farm sector is unutilised.

Causes for low agricultural productivity in India :

a) High pressure of population on land. Excess pressure results in disproportionate utilisation of land along with an unsatisfactory system of crop rotation and inadequate land reclamation.

b) **Institutional Factors :**

1] **Size of holdings** : The average size of holding in India is between 2 to 5 acres. Fragmented holdings impede the application of scientific cultivation and improved implements.

2] **Defective land tenure**: Inspite of abolition of intermediaries and tenancy reforms, the position of the tenants is precarious without any security of tenure hence their motivational levels are low.

c) **Technological Factors :**

1) **Inadequate irrigation facilities**: The net irrigated area as a percent of net sown area is 42% for all India as a whole. Lack of irrigation exposes India's agriculture to the vagaries of the monsoon and also does not permit application of modern inputs.

2) **Poor Techniques of Production**: The fertilizer and manure use intensity is quite low and the use of pesticides is also low. There is sub-optimal use of manure. Bad storage and poor post-harvest technology compounds the problem.

3] **Inadequate non-farm services**: Non-farm services like marketing, finance, transport are inadequate leading to rural indebtedness and distress sales. Inadequate development of the co-operative movement and inadequate storage facilities are other problems.

4] **Low output of farm research**: The farm research in India has only reached general conclusions. There is very poor transfer from lab to land and extension is confined to individual appropriate practices but no complete farming pattern has been evolved.

d) **Environmental factors :**

1. **Soil Degradation** : 50% of land area is affected by soil erosion and about 21% of land area is under severe stage of degradation. About 30 million hectare are affected by floods and 68 million hectares are affected by drought. All these have reduced the agricultural potential of Indian soils.

21. THE GREEN REVOLUTION IN INDIA

The phrase Green Revolution is used to denote the sharp increase in the output of foodgrains in India after the mid – 60's due to the implementation of a package of agricultural practices, use of modern technological inputs, along with provision of infrastructural and institutional support. The Green Revolution in India began with the implementation of the Intensive Agriculture Development Programme (IADP) in 1961 as a pilot project in 7 districts in 7 states. Due to its success, it was extended to other parts of the country. The main components of the IADP and hence the Green Revolution were use of HYV, artificial irrigation, intense use of chemicals as technological inputs, land reforms, agricultural R and D as institutional inputs and appropriate cropping pattern, scientific land, soil and water management practices, development of rural infrastructure in the form of rural roads, rural electricity and agricultural credit as infrastructural inputs.

The Green Revolution succeeded in increasing the output of foodgrains and also modernization of agriculture in regions with irrigation facilities. The most important food crops that benefited because of the green revolution were wheat, rice, bajra and the

most important non-food crops which benefited due to it were sugarcane and cotton. The Green Revolution made India self-reliant in food grains and also sharply increased the value of India's agricultural economy. However, it also led to certain undersirable consequences in the form of imbalances in foodgrain agriculture, accentuation of regional disparities and ecological imbalances due to the intensive agricultural practices (which include intense irrigation, intense use of chemicals large scale use of HYV and so on).

22. JHUM CULTIVATION IN INDIA

Jhum cultivation refers to shifting cultivation. This is practiced by the primitive tribes of the hilly forested regions in the tropical regions of India. The tribes create agricultural land by clearing forests after felling the trees and burning the stumps. The arable land so created is cultivated for two to three years and abandoned for around 10-15 years due to decreased soil fertility. Jhum cultivation is characterised by primitive methods and there is complete absence of modern inputs. The main crops that are raised in the Jhum cultivated regions of India are dry paddy, maize, buck wheat, small millets and sometimes tobacco. Jhum cultivation occupies an area of nearly 5.5 m.ha. Jhum or shifting cultivation is known by different names in different regions of India like Jhum in northeast, Bewar in M.P. and Chhattisgarh, Podu in A.P., Ponam in Kerala and so on. It is widely practiced by the Garos, Nagas, Gonds, the Kurumbas, the Gerasias and other tribes on India.

23. DRYLAND AGRICULTURE

Of the total agricultural area of 162 million hectares (m.ha), Drylands occupy 105 m.ha, Dry farming zones are regions receiving annual rainfall ranging from 375 mm to 1125 mm. Drylands are therefore environments with a significant permanent, seasonal or periodic shortage of water. These drylands include the semi-arid regions of peninsular India and the hyper-arid regions of the northwest i.e., in Gujarat and Rajasthan. Dry farming refers to either crop production based entirely on rain water received during

the crop growing season or crop production based on conserved soil moisture in areas of low rainfall. Agriculture in drylands is adversely affected by: inadequate and often erratic rainfall, soils of dryzones suffer from varying degrees of soil erosion and soil salinisation; fragmented agricultural holding; low socio-economic status of the farming communities and lack of adequate crop varieties suited to the agro-climatic conditions of these regions. The drylands account for nearly 42% of India's foodgrain output, around 10% of India's GDP and nearly 42% of India's population derives livelihood from these areas. The drylands account for 73% of all crops on the basis of the percentage of area under rainfed farming. Specifically, they account for nearly 60% of paddy area, more than 90% of the area under pulses, around 70% of area under cotton and around 90% of area under groundnut.

24. FISHERIES DEVELOPMENT

India is one of the 10 largest fishery countries in the world. Today half each of India fish output comes from marine and inland sectors. India has enormous fishery potential in both offshore and inland sectors. Marine fishery potential is around 20 to 25 million tonnes. This potential lies in the 6.68 lakh square kms of continental shelf area including the shelf area in India's EEZ, the 20.2 lakh square km area under India's EEZ and a 7500 km coastline. Within the marine sector, the inshore sector i.e., upto 8 kms from the coast, has 10 times more potential than the offshore sector. In the offshore sector, the Indian ocean is considered to be very rich in pelagic species like mackeral, sardine, tuna and others. In the offshore areas, the deep sea fishery potential mainly includes the demersals which live on the sea-floor. These include the crustaceans. The freshwater fishery potential of India is in the length of fishable orivers (which is 27,389 kms), the irrigation canals with a total length of 1,12,654 km, a 2.9 m.ha. area of reservoir / lakes and about 2.6 m.ha. of brackish water area. The fifth and sixth 5-year plans launched programmes for development of inland fisheries. These are Fish Farmer Development Agencies (FDDA) and National Programme for Fish Seed Development (

NPFSD). Around 5 lakh hectares have been brought under fish culture through the efforts of FFDDA. Many fish seed hatcheries have been set up under NPFSD. To promote marine fisheries, efforts include the setting up of 5 major fishing ports (Vizag, Kochi, Chennai, Roychowk, Paradwip and Sassoon Dock at Mumbai), setting up Brackish Water Fish Farmers Development Agencies and assistance to fishermen to motorise their craft.

25. DAIRY DEVELOPMENT

Efforts to develop the dairy sector in India began with the launch of the Anand Model in Gujarat. The Anand Model basically organized the milk producers into cooperatives and also included an efficient system of transport of milk and its supply to urban centres. Encouraged by the success of the Anand Model, India launched Operation Flood-I in 1970-71 under which a National Dairy Development Programme was launched in 10 states and milk supply to the four metros of Mumbai, Kolkata, Chennai and Delhi. Due to the huge success of Operation Flood-I, India launched Operation Flood-II in 1978 which aimed at organizing milk marketing in 144 cities other than the four metros and other features such as improvement of breeds, improving fodder supply to milch cattle and so on. Operation Flood-III was launched in 1987 with assistance from the World Bank and the E.U. Its immediate aim was to set up 170 milk centres to benefit 250 districts in 22 states. As a result of these programmes under operation Flood, milk production in India went up from 21 million tones before operation Flood-I to around 110 m.t. today. It also raised the per capita availability of milk in India. In addition, it has led to organization of nearly 8.4 million farmers into 65,000 dairy cooperatives. As more than 62% of the milk procurement under Operation Flood comes from marginal, small and landless, it has raised their incomes.

26. AGRO-CLIMATIC PLANNING

Agro-climate planning refers to planning based on the harmonious correlation between climatic factors and agricultural practices for the scientific utilisation of all available resources (natural and man-made) to boost produciton, income, employment and to reduce the imbalances in agricultural growth. The objectives of agro-climatic planning are : 1. Optimal utilisation of land and water sources 2. To bring down unemployment and poverty by suitable agricultural and livestock strategies. 3. To improve the income of farmers 4. Increase agricultural productivity 5. Preserve the eco-system

Strategy: The country is divided into several agro-climatic zones delineated on the basis of climatic factors, soil type, water resources besides taking into account demographic factors (like pressure of population on arable land), land and livestock resources, crop production and productivity, input use and environmental factors. After studying all these factors i.e. the assets and limitations in each region, appropriate agricultural and livestock strategies are formulated for the optimal utilisation of land, water, livestock and human resources in each region.

Measures Taken : 1. The country has been divided into 15 Agro-climatic regions based on soil type, rainfall, temperature characteristics etc. 2. An Agro-climatic Atlas for the entire country has been published in 1975. 3. Zonal planning teams have been set up for each region. 4. An Agro-climatic classification for regional crop planning has been made.

27. AGRO - METEOROLOGY

Agro-meteorology is an applied science blending problems of agriculture with meteorology. More specifically, it deals with the qualitative and quantitative relationships between weather conditions and agricultural operations.

The Need For Agro-Meteorology : 1. Weather conditions play an important role in affecting crop production. In fact, 50 per cent of variations in yield from year to year are due to climatic factors. 2. Weather-based agro-meteorological practices help in : selecting

efficient crops for a region; appropriate schedules of sowing seeds and application of fertilisers; application of chemical inputs/sprays and irrigation inputs and appropriate harvesting and post-harvest operations. 3. The existing forecast system of 24 to 48 hours does not help farmers to take adequate steps for contingent action. 4. The present agro-advisory forecasts are for broad areas and of a general nature and hence do not indicate the steps the farmers should take in a specific place. 5. Agro-meteorology is also useful since it studies crop destructive meteorological phenomena like effects of drought, floods, dust storms on crop quality and yield.

Components of Services Provided Under Agro-meteorology : 1. Agro-meteorological information for crop planning. 2. Agro-meteorological forecasts with advisories for farming operations. 3. Demonstrating the usefulness of weather information for farming practices. 4. Carrying out R and D to understand crop-weather relationship.

Efforts made in India : 1. 131 Agro-meteorological observatories have been set up all over the country. 2. Around 17 Agro-meteorological services are operational in various states. 3. All-India Co-ordinated Project on Agro-meteorology has been launched in 1983 at the Central Institute for Dryland Agriculture (CRIDA), Hyderabad, with co-ordinating centres in Indian Agricultural Research Institute (IARI), New Delhi, Central Arid Zone Research Institute (CZARI) Jodhpur and North East Hill Complex, Shillong. 4. Training facilities at post-graduate level have been created in Punjab Agricultural University (Ludhiana), Haryana Agricultural University (Hissar), Gujarat Agricultural University (Anand) and Mahatma Phule Krishi Vidyapeeth (Pune).

28. OIL AND GAS RESOURCES OF INDIA

The oil and gas resources of India are confined to the sedimentary rocks belonging to mesozoic and cenozoic eras. A major part of peninsular India is considered to be geologically unfavourable for the occurrence of petroleum oil and natural gas since it is made up of very old igneous and metamorphic rocks. The total sedimentary cover of India distributed across 27 sedimentary basins is 1.72

million square kms. These sedimentary basins include offshore mesozoic and cenozoic rocks with an area of 2.5 lakh sq kms upto a depth of 100 metres and 0.7 lakh square kms between 100-200 metres. The sedimentary basins of India have prognosticated reserves of 21 billion tonnes of oil and oil equivalent of gas. Around 60% of these reserves are in the offshore areas. About half of this reserve is in Bombay High, the Cambay basin (offshore and onshore, Gujarat) and in Assam including other areas of the northeast. The promising areas with large potential are the deltaic areas (both offshore and onshore) of Krishna-Godavari, Mahanadi, and Cauvery, the Andaman sea, the Gulf of Mannar, the Ganga delta, the Thar desert and the valleys of Himachal.

29. COAL RESOURCES OF INDIA

India ranks 6th in the world reserve of coal. Coal reserves of India include the bituminous coal and lignite deposits. Much of India's bituminous coal occurs in the Gondwana rock formations which belong to the Paleozoic and Mesozoic eras. In fact, 80 coalfields of the 113 major coalfields of India belong to the Gondwana coal. The recoverable reserves of coal in India are around 52 billion tonnes (b.t.) of the total reserve of 248 b.t. The states with the largest reserves of coal are Jharkhand followed by Orissa, Chhattisgarh, W. Bengal. And M.P. Coalfields occur in the Damodar valley of Jharkhand (Giridih, Jharia, Bokaro, Karanpura) and W. Bengal (Ranigung coalfields), the Mahanadi valley coalfields of Orissa (Talcher and Sambalpur), Chhattisgarh (Korba coalfields) and M.P. (Sonepat), the Son valley coalfields of M.P. (Singrauli), Chhattisgarh (Sohagpur) and Jharkhand (Daltongung and Huttar), and the Godavari Valley coalfields of A.P. (Singareni fields) and Maharashtra (Kamptee and Ballarshah).

In India Lignite deposits occur in younger rock formations of Tertiary period. The largest reserves are in Tamil Nadu (Neyveli) followed by Gujarat (Kutch and Bharuch) and Rajasthan (Palana in Bikanner).

30. GEMSTONE DEPOSITS OF INDIA

Gemstone deposits of India include diamonds, sapphires and rubies, and emeralds. The diamond deposits of India occur in the Kimberlitic rocks. The main reserves are in Majhgawan (Panna in M.P.), Raipur in Chhattisgarh and Vajrakarur in Anantapur, in A.P., Sapphires and rubies mainly occur in Madurai (T. Nadu), Hassan (Karnataka) and Kishtawar (J&K). Emerald deposits mainly occur in Ajmer and Udaipur (Rajasthan) and Kulu in Himachal.

31. ATOMIC MINERALS OF INDIA

The nuclear or the atomic minerals of India are Monazite, Uraninite, Pitchblende, Zircon, Ilmenite and Thorianite. The Black sands of Malabar contain large reserves of monazite, Zircon and Ilmenite. Large deposits of Pitcblende occur in Singhbhum district of Jharkhand (in Jaduguda, Dhantupa and Narwa Pahar). The Black sands of the east coast off Vishakapatanam contain Ilmenite, monazite and zircon. Uraninite deposits occur in Jhunjhunu, Udaipur and Alwar districts of Rajasthan. Mineral monazite occurs in Gaya in Bihar and also in the Black sands off the coast of Orissa in Ganjam and Cuttack.

32. MAJOR PORTS OF INDIA

The major ports of India have been guided in their location by a series of factors like availability of natural harbours, strategic value of a site, proximity to international sea routes, the need to decongest some ports and so on. On the eve of planning, there were 5 major ports handling around 19 m.t. of cargo. These have risen to 12 major ports landling close to 550 m.t. of cargo. The major ports of India handle 95% of India's trade by volume and around 40% by value. These ports are fundamental in India's foreign trade for export and import of bulk and heavy commodities and sustain a large number of industrial, infrastructural and mining sectors which are involved in these sectors. They directly sustain India's shipping industry and also provide direct employment to around one lakh forty thousand people besides providing indirect employment to

workers in infrastructure, industry and mining which are linked to India's foreign trade. They serve large hinterlands along the west and the east coasts and also contribute significantly to the non-tax revenue of the centre.

33. INLAND WATER TRANSPORT

India has 14,352 kms of navigable waterways, of which only 5200 km are navigable by mechanised craft. The potential for inland water transport is in the navigable stretches of the Himalayan rivers in the Indo-Gangetic plains with the intense industrial and agricultural activity. Most peninsular rivers are also navigable in their lower reaches. The potential is also present in the long network of canals for irrigation, with their total length of 1,12,654 kms. In addition, the backwaters of Kerala are also navigable. The inland water transport sector with its advantage of being cost-effective over the road and rail sectors, can be developed if appropriate steps are taken. These would be dredging the river channels and canals, developing navigational aids along them and promoting industrialisation near these waterways. Efforts to develop the inland water transport sector began in 1952 with the establishment of the Ganga Water Transport Board for promoting water transport along Ganga. A Directorate of Inland Water Transport under the Ministry of Surface Transport was set up in 1967 to supervise all matters pertaining to inland water transport. The National Waterways Act was enacted in 1982 to develop national waterways under which three waterways i.e., Allahabad - Haldia, Sadia-Dhubri and Kothapuram-Kollam have been declared as National Waterways. The Inland Waterways Authority was set up in 1986 as the apex administrative agency to oversee all matters pertaining to national waterways.

34. RACIAL GROUPS OF INDIA

The people of India belong to the following racial groups:

A) **Negritos** : The Negritos are characterized by short stature, dark skin, woolly hair, a bulbuous forehead and slightly protruding jaws. The Negritos were the first to arrive in India. The Negritos are represented by the people of Andaman and Nicobar, the Uralis of Nilgiris, the Badgis of the Rajmahal hills in Jharkhand and so on.

B) **The Proto-Australoids** : This racial stock followed the Negritos into India. Their physical appearance is close to that of the Negritos but they do not have woolly hair. Today they constitute the bulk of population in many isolated and semi-isolated parts of central and southern India. The Irulas, the Veddahs and the Malavedahs of S. India are the true representatives of this race. However, the Bhils, the Kols, the Mundas of central India and the Chenchus and Kurumbas of S. India may be taken to represent the proto-Australoids.

C) **The Mongoloids** : The people of this race have a round and a broad head, high check bones, a hairless skin and a long flat nose. The mongoloids of India belong to the a) Paleo – Mongoloids who are represented by the tribes of Himalayan fringes in Assam and Myanmar border and b) The Tibeto-Mongoloids who are represented by the people of Sikkim, Ladakh and Baltistan.

D) **The mediterraneans** : These people are of medium stature, a dark skin and a long head. The Paleo-mediterraneans, a sub-type of this race, constitute a bulk of India's population in the north and the south.

E) **The Brachycephals**: They have broad heads and came from Central Asia. The Brachycephals are made up of the Alpinoids, the Dinarics and the Armenoids. They are represented by the Coorgis and the Parsis.

F) **The Nordics** : These were the last to come to India. These are the Indo-Aryans with long head, fair skin, a strong and well built body. They are represented by the people of Punjab, Haryana and Rajasthan.

35.THE LANGUAGES OF INDIA

The languages of India fall into the following categories :

A) The Indo-European Family - These are the Aryan languages. About 73% of the Indian population speak the languages of the Aryan family. The Aryan languages are sub-divided into Dardic Aryan and Indo-Aryan languages. The Dardic Aryan languages are spoken by some mountain communities of Kashmir and include languages like Shina, Kashmiri and Kohistani. The Indo Aryan languages include Bengali, Punjabi, Hindi, Rajasthani, Gujarati, Sindi, Marathi, Oriya Sanskrit, Assamese and Urdu.

B) The Dravidian languages - These are older than the Aryan languages and include: a) North Dravidian languages like Telugu, and dialects like Gondi, Oraon, Parji, Kolami and others b) The South Dravidian languages which include Tamil, Malayalam, and Kannada.

C) The Austric languages of India are subdivided into a) Munda (or Kol) which are the largest of the Austric group and principally include tribal languages like the Kherwari group which includes Santhali, Mundari, Korwa and others and b) the Mon-Khmer languages which includes Khasi and Nicobarese.

D) The Sino-Tibetan languages of India include the Tibeto-Himalayan group which includes Chamba, Kannauri, Bhatia group (Balti, Ladakhi and others), the North Assam languages (like Aka, Daffla, Miri, Mishing and others) and the Assam – Myanmari languages (which include Bodo, Naga, Manipuri, Garo and others).

36. DEMOGRAPHY OF RELIGION

The Hindus account for 81.4% of India's population according to the 2001 census. They constitute the majority community in most states and union territories except in Jammu and Kahsmir, Punjab, Meghalaya, Mizoram, Nagaland and Lakshadweep. Hindus account for 95.4% of the population in Himachal, 94.7% in Chhattisgarh, 94.4% in Orissa and 91.1% in M.P. In terms of absolute size, UP has the largest number of Hindus followed by Maharashtra, Bihar and A.P. 9 states of India (including the 4 above and Tamil Nadu, Rajasthan, Karnataka, W.Bengal and MP) account for three-fourths of the Hindu population. The Muslims, the second largest religious community and the largest minority community of India, account for 12.4% of India's population according to the 2001 census. Spatially, pockets of Muslim concentration are the Kashmir valley, Malappuram in Kerala, the Rohilkhand region of U.P., Upper Ganga Plain of Uttarkhand and Lakshadweep. Jammu and Kashmir has 67% of its population as Muslim, followed by Assam (31%), W. Bengal (25.2%) and Kerala (24.7%). In terms of absolute size, Muslim population is the largest in U.P. followed by W.Bengal, Bihar and Maharashtra. The Christians account for 2.3% of India's population according to the 2001 census. The Northeast is a major region with high concentration of Christians. Christians account for 90% of the population in Nagaland followed by Mizoram (87%) Meghalaya (70.3%) and Manipur (34%). Christian population is also large in Kerala (19%) of its population) and Goa (26.7% of its population). Kerala has the largest size of Christian population with high concentration in Kottayam and Ernakulam. After Kerala, Christian population is largest in Tamil Nadu, Arunachal Pradesh and Meghalaya. The Sikhs constitute 1.9% of the total population according to the 2001 census. The areas with large concentration of Sikhs are Punjab, Haryana, Delhi, the Terai of Uttarkhand and Alwar and Ganganagar in Rajasthan. Sikh population as a percent of state population is highest in Punjab followed by Haryana, Uttaranchal and Jammu and Kashmir. Buddhists constitute 0.8% of India's population according to the 2001 census. Maharashtra has the largest Buddhist population (around 73% of India's Buddhist population). Buddhist population as a percent of state population is highest in Sikkim followed by Arunachal, Maharashtra and Himachal Pradesh. Spatially pockets of concentration of Buddhists are in Ladakh, Arunachal, Himachal, Maharashtra and Karnataka. Jain population constitutes 0.4% of India's population according to the 2001 census. Spatially Jain population shows high concentration in western India i.e., in M.P., Rajasthan, Maharashtra, Gujarat and U.P.

Jain population as a percent of state population is highest in Maharashtra followed by Rajasthan, Gujarat and M.P.

37. DEMOGRAPHY OF TRIBAL POPULATION

The spatial distribution of tribal population in India shows a striking tendency of clustering and concentration in pockets. This is primarily because of isolation and due to the dependence of the tribes on forests. The ST's account for 8.2% of India's population according to the 2001 census. According to the 2001 census, 94.5% of the total population is tribal in Mizoram and Lakshadweep, followed by Nagaland (89.1%), Meghalaya (85.9%) and Arunachal Pradesh (64.2%). In terms of absolute size, the largest number of ST's are in M.P., followed by Maharashtra, Orissa and Gujarat. Among the 15 major states of India, ST population as a percent of state population is highest in Orissa, followed by M.P., Gujarat and Rajasthan. If all the states are taken together, the ST population as a percent of state population is highest in Mizoram, followed by Nagaland, Meghalaya and Manipur. About one third of ST population of India lives in the three states of M.P., Maharashtra and Orissa. Around 57 districts of India (about 10% of the total districts) have more than 60% of their population as tribal. These districts lie in the Northeastern states, in the border between Rajasthan, Gujarat and M.P., in the Chotanagpur plateau, in parts of Himachal, Jammu and Kashmir and Chhattisgarh. Thus the spatial distribution of tribal population shows a high concentration in the Northeast, the central Indian Highlands between Aravallis, the Vindhyans and the Sahyadris and the belt between the Orissa hills and Chotanagpur plateau.

38. DEMOGRAPHY OF SCHEDULED CASTE POPULATION

The scheduled castes numbering around 542, constitute 16.2% of India's population according to the 2001 census. Unlike the ST's who have a tendency to concentrate in the remote and hilly areas, the SC's do not show this tendency for clustering. The SC population shows a very high concentration in the Indo-Gangetic plains and the coastal plains. According to the 2001 census, UP has the largest number of SC's followed by W.Bengal, Bihar and A.P. The two

states of U.P. and W. Bengal alone account for nearly one-third of India's SC population. SC population as a percent of state population is highest in Punjab followed by Himachal W. Bengal and U.P. About 13 states and union territories of India have 15 to 20% of their population as SC. It may also be noted that around 61 districts of India (i.e., over 10% of the total districts) have over one fourth of their total population as SC's. Most of these districts are in the northern plains of India.

39.FLOODS IN INDIA

Floods occur when the capacity of a river channel is exceeded. Floods bring about increased discharges, high average velocities, high sediment discharges, inundation of floodplains, erosion of river channel and damage to farm land / property.

Causes of Floods in India: 1) Heavy precipitation, often exceeding 15 Cms day, causing flash floods and heavy concentration of silt. 2) Cyclones and depressions in the Bay of Bengal lead to strong winds and often widespread rainfall. The damage is caused by both gusty winds and floods. These are typical to coastal areas of A.P., Orissa, W. Bengal and Tamil Nadu. 3) Siltation of river beds and hence spilling of rivers over river banks. 4) Inadequate drainage arrangements to tackle excess discharges of water. 5) Indiscriminate deforestation in the catchments areas in upper reaches of river basins – especially in the Siwalik basin, Assam Himalayas and Chotanagpur plateau. 6) Jhum cultivation in the Northeast leading to deforestation and flooding in Brahmaputra plains. 7) Obstruction of free drainage due to developmental projects like dams and hydel power projects.

Flood Prone Zones in India: Almost all the rivers in India cause floods in one or more of their lower reaches. Areas which are subjected to severe floods are in the Northern Plains of India. In general, the major groups of regions that are recognized are: 1) River basin areas of Ganga – Indus and Brahmaputra and their tributaries. 2) River basins of the Northwest covering parts of Punjab, Western U.P., Haryana where the Jhelum, Sutlej, Ravi, Beas and Chenab flow. 3) East coastal tracts are exposed to floods due to cyclones depressions. 4) Peninsular river basins covering parts of Maharastra, Orissa, A.P., M.P. where Narmada, Tapti, Godavari and Cauvery flow. 5) Windward slope regions of Gujarat plains and Konkan plains.

National Flood Control Policy (1954): This policy suggested short-term measures to tackle the flood problem. **A) Short-term measures:** Include improvement of surface drainage, establishment of proper flood warning systems, shifting or raising of villages over flood-level, building, channel diversions and construction of raised platforms. **B) Long-term measures:** Include construction of dams or storage reservoirs for flood protection and soil conservation in catchment areas of various rivers, building detention basins and digging larger channel diversions.

40 .DROUGHT IN INDIA

Droughts are basically related to weather conditions but their affects can be intensified due to some socio-economic factors. Meteorological drought is related to deficiency of rainfall. Hydrological drought is related to water flows into rivers, lakes, ponds, tanks, wells etc. Agricultural drought is related to weather, soil, crop and cropping pattern and management practices. Meteorological and agricultural droughts are related to on-site weather conditions that affect rainfed farming while hydrological drought also includes the weather conditions in catchment areas.

Causes of Drought in India: 1) Variability of annual rainfall. Areas of medium and low rainfall have high rainfall variabilities leading to crop failures and drought. 2) Delay in onset of monsoon and early withdrawal of monsoon may lead to failure of crops / reduced yields. 3) Breaks in monsoon – long breaks in monsoon rains causes considerable damage to standing crops. 4) Areal differences in persistence of monsoon leads to disturbance of agricultural practices / crop failures. 5) Inadequate irrigation facilities in dryland regions leads to rain water going waste and drought. 6) Inadequacies in farm practices like faulty cropping pattern, lack of soil/water conservation, poor management of traditional resources of irrigation (like tanks, ponds, wells), neglect of water-harvesting structures etc. 7) Environmental factors such as soil erosion, soil salinity / alkalinity (due to canal irrigation) deforestation of catchment areas etc.

Drought Prone Regions of India: One-third of India's geographic area is vulnerable to drought. These areas receive rainfall of less than 60 cms per year and they also do not have adequate irrigation facilities. The main drought-prone regions of India are: 1) Low rainfall

regions on the lee side of W. Ghats getting less than 60 cms of rainfall. The region stretches in a north-south fashion covering parts of Maharashtra, Karnataka and A.P. 2) Arid and semi-arid regions in northwest parts of India covering most parts of Rajasthan, Gujarat (especially Saurashtra region) and parts of adjoining states. 3) Isolated areas such as southern districts of Tamil Nadu, southwestern districts of U.P. (like Varanasi), the rain shadow regions of Palamu and Singhbhum districts of Jharkhand, rain shadow/low rainfall regions of South Chotanagpur plateau and Keonjhar, Phulbani, Kalahandi, Bolangir and Koraput districts of Orissa.

41. DESERTIFICATION IN INDIA

As per the UNEP, land degradation in arid, semi-arid and dry sub-humid areas resulting from adverse effects of human impact is termed desertification. The march of the sand dunes is only a small part of desertification. In India, the arid zone of the dryland regions making up more than 100 million hectares including the truly arid zones (like the Thar Desert) are exposed to the problem of desertification. The truly arid zones like the Thar account for 12% of India's total land area.

Causes: 1) Climatic: The climatic factors give birth to the truly arid zones like the Thar. These zones are located within the sub-tropical belts of high pressure on western margins of continents where warm/dry offshore winds blow throughout the year bringing no rainfall. 2) Topographic factors: The lee regions of mountainous areas get scanty rainfall and are perennially drought prone like the lee regions of W. Ghats in Karnataka and Telangana in A.P. 3) Lack of orographic barriers to cause rainfall like the Aravallis which lie parallel to South-West monsoon currents. 4) Siltation due to flooding leading to soil erosion. 5) Mining / quarrying as in Aravallis, Kumaon/Garhwal (Uttarakhand) and limestone quarrying in Himalayan foot hills. 6) Deforestation due to expansion of urban areas and building of developmental projects, jhum cultivation and indiscriminate tree felling by timber mafias lead to march of sand dunes. 7) Overgrazing in fragile eco-systems leading to intensification of arid formation. India has the world's larges livestock population but has only 13 million hectares of pasture land i.e., about 4% of total land area leading to overgrazing and land degradation. For e.g., the Thar region supports a

huge cattle population leading to high pressure on grazing land which is the primary factor for speeding up of aridification of Thar.

Steps Taken : 1) Afforestation programme including social forestry. 2) Desert Development Programme launched in 1977-78 which includes measures to halt march of deserts, restore ecological balance in desert/arid regions, pasture development and development of land/water resources in these regions. The DDP covers 3.62 lakh square kms. 3) Drought Prone Areas Programme was launched in 1973 as a long term integrated area development programme for restoration land/water/livestock/human resources. 4) A Wasteland Development Programme was launched in 1985

42. WASTELANDS IN INDIA

Wastelands Defined : All vacant lands lying unused for having become unproductive as a result of topsoil erosion due to causes like soil erosion, deforestation and development of soil toxicity are referred to as wastelands.

Extent of Wasteland in India: About 130 million hectares (m.ha.) in India's total land area of 329 m.ha. is classified as wasteland. This also includes 94 m.ha. of non-forest wasteland. Of the 94 m.ha. of non-forest wasteland, nearly 74 m.ha. have been rendered waste due to water and wind erosion, and spread of saline/alkaline soils. Statewise, Rajasthan leads with maximum area as wasteland followed by Madhya Pradesh and Maharashtra. The rest of wastelands are spread over Gujarat, Orissa, Bihar, West Bengal and Sikkim.

Causes : All factors which lead to topsoil erosion constitute causes for the development of wastelands. These include deforestation (about 1.5 m.ha. of forestry cover is lost annually due to which 12,000 million tones (m.t.) of topsoil is last annually), soil erosion due to floods, drought and wind action (about 50% of India's land area is affected by soil erosion, about 30 m.ha. are affected by floods annually, about 68 m.ha. are affected by drought annually). In fact, 21% of Indja's land area is in a severe state of degradation. Overgrazing due to limited availablility of pasture land is a major cause.

Measures Taken: The National Wasteland Board was set up in 1985 with a mandate of reclaiming 5 m.ha. of wastelands every year primarily through afforestation. The Department of Wasteland

Development has launched several scheme and measures for reclamation of wastelands. 1) It has initated a comprehensive plan for the development of 94 m.ha. non-forest wasteland which include the following programme components. a) Integrated land-use planning b) Preparation of village level action plans c) Creation of sectoral linkages at implementation level planning on a watershed basis. c) Provide financial support to non-government organizations (NGO's) with an additional programme to build on work done by existing NGO's. 2) The Department of Wasteland Development has launched 5 schemes a) Integrated wasteland development programme b) Production of fuelwood and timber c) Grants-in-aid to NGO's and voluntary organizations d) Raising nurseries for afforestation e) Programmes for realizing margin money from wastelands developed. 3) The Department has also identified 147 districts for reclamation of wasteland. The 147 districts have 15% of area as wasteland. Microplans have been prepared for 45 most affected districts. 4) It has also initiated an experiment to revegetate the saline lands of India (about 7 m.ha. of land in 14 states of India suffer from high salinity and alkalinity). The experiment will involve technology evolved by Australia for wasteland reclamation which basically involves vegetating with salt tolerant species like a triplex.

Other General Measures : 1) Revision of forest policy in 1988 to prevent conversion of forestland to non-forest use, promote afforestation and protect existing forests. 2) Centre has proposed to give major thrust to wasteland development of linking it with Jawahar Rozgar Yojana and other such rural development programmes. 3) About 330 voluntary agencies are engaged in the task of wasteland\s development in India. 4) The centre has embarked upon a programme of identifying committed voluntary agencies which will be given the task of motivating and organizing communities for protection, afforestation and development of wastelands, especially in vicinity of habitations.

Objectives of Wasteland Development in India: The overall objectives of Wasteland Development in India are: 1) Improvement and stabilization of soil and water regime to an optimum level. 2) Planting suitable trees/legumes/grasses for the production of fuel, fodder, small timber and also meet other requirements of people. 3) Prevent further expansion / extension of wastelands.

43. SOCIAL FORESTRY

Background: 1) Large scale deforestation i.e., forest cover is being lost at the rate of 1.5 million hectares per annum 2) Acute scarcity of fuelwood in rural areas. 3) Loss of farmland manure to soil because of its use in rural energy requirements. Based on a comprehensive review of the state of forestry in the country, the National Commission on Agriculture recommended three programmes in 1976 for implementation. 1) Afforestation of degraded forest land. 2) Development of productive forests to meet commercial wood and timber requirements. 3) Development of social forestry to meet the fuelwood, fodder, timber requirement of the rural population. Forming one of the important components of the 20-Point Programme, the social forestry scheme was launched in 1980-81 in 101 districts as a centrally sponsored programme. The scheme includes, "A tree for every child" and Rural Fuel wood Plantations. The basic philosophy of the social forestry programme is to prevent the diversion of agricultural land to non-agricultural use and for maintaining environment conducive to living.

The three main components of social forestry programme are: **1) Farm Forestry:** This is with the objective of encouraging farmers to plant and raise trees through subsidized and free supply of seedlings. **2) Rural Forestry:** This is for the benefit of the rural community as a whole through massive plantations and along roads, canal banks, tanks and in fallow uncultivable waste. **3) Community Woodlots:** These are planted by particular communities themselves on their own lands and the benefits are shared equally by them.

Specific Components of Social Forestry: 1) Village woodlands on community and government lands. 2) Block plantation in tank beds and foreshore lands. 3) Agro-forestry on marginal and sub-marginal lands 4) Tree planting along homesteads and field boundaries. 5) Development of pasture and silvipasture 6) Afforestation of degraded areas 7) Tree plantation in industrial and urban areas to combat noise and water pollution 8) Control of water and wind \erosion by tree and shrub planting which will act as shelter belts and noise protection belts. 9) Strip plantation along canal, rail and roadsides.

Importance of Social Forestry:

1. **Fuelwood:** This contributes or accounts for 36% of the total energy consumed in the rural areas. Hence planting trees like

Acacia, Eucalyptus and Leucalina, the fuelwood requirements of the rural populace can be met.

2. **Food:** Tree species like Magnifera Indica, Aegle Marmelos, Syzygum Cumini are important sources of food for rural and tribal people. The trees also produce protein rich seeds and fruits.

3. **Fodder:** The grazing lands will be provided by social forestry with fodder species like Acacia, Arabica, Terminolia Arjuna etc.

4. **Rural Cottage Industry :** The social forestry plantations provide raw material for rural cottage industry like gum, lac, metal rope, resin, silk, soap etc.

5. **Employment:** Unskilled labour can be gainfully employed in preparation of beds, weeding, watering, fencing and planting. It is estimated that in the primary and secondary sectors forestry activities generate approximately 240 million man days of employment per annum

6. **Environment:** In maintaining and regeneration of ecological balance.

Thus, social forestry is a harmonious programme integrating human beings, animals, trees i.e., it combines idle labour, idle land and water resources for optium production of firewood, fodder, food, manure and small timber.

44. BIOSPHERE RESERVES IN INDIA

A biosphere reserve consists of totality of plant, animal and micro-organisms as an interdependent system. Biosphere reserves being set up all over the world are part of the Man and Bio-sphere Programme of the UNESCO- initiated in 1971. The objectives of the Man and Biosphere Programme are: 1) Conserve the ecosystem b) Promote sustainable management of the living resources of a reserve c) Promote international co-operation in conserving / managing biosphere reserves. d) Conserve genetic diversity e) Facilitate basic and applied research in genetic diversity.

What is a biosphere reserve: Basically, a biosphere is an ecology containing plant/animal/micro-organic life as an interdependent

system. In a biosphere reserve therefore, endemic species inhabiting a particular geographic area co-exist true to their nature and hence the food chain is undisturbed. In other words a biosphere reserve offers an endemic species a biorhythm familiar to it.

Aims of Biosphere Reserves: 1. The need for conserving eco-systems of a larger size to ensure self-perpetuation and unhindered evolution of living organisms. 2. In-situ conservation of plants/animals and micro-organisms not in isolation but in their totality as part of a wider eco-system. 3. Conserve biodiversity 4. Promote research on ecological conservation and other environmental aspects. 5. Provide facilities for education, awareness and training.

How are biosphere reserves different from wildlife sanctuaries and national parks:

1. Unlike in wildlife sanctuaries and national parks, tourism is not permitted in biosphere reserves.
2. Boundaries of biosphere reserves are delimited by acts of legislature unlike the boundaries of wildlife sanctuaries and national parks.
3. National parks are habitat oriented and wildlife sanctuaries are species oriented but biosphere reserves are ecology oriented.
4. There is no biotic interference in biosphere reserves as in the case of parks / sanctuaries.
5. Research and Management is poor in most parks and sanctuaries.

45. MANGROVE FORESTS IN INDIA

Mangroves are salt-resistant and salt-tolerant forest eco-systems found mainly in the tropical, subtropical and inter-tidal regions.

Uses: 1) The organic detritus from mangrove leaves/litter forms the basis of food chains which nourish a wide variety of marine and estuarine fauna including crabs and oysters, prawns and fishes. 2) Mangrove forests along the coasts stabilize the shoreline and check coastal erosion by sea. 3) The network of anchored and breathing roots of mangroves trap sediments and thus build up land. It is believed that mangroves march into the sea at the rate of as much as

100 metres a year leaving behind built up land for other uses. 4) Mangroves are important wildlife habitats holding rich potential for recreation, sports and nature study. They are excellent reservoirs for wide variety of organisms. 5) Like wetlands, mangrove vegetation minimizes the impact of storms/cyclones thereby minimizing loss of life and property. 6) Mangroves have their economic utility as they provide a wide variety of materials including food, fodder, wood salt, honey, oil wax, dyes, tannins, medicinal products and fibre.

Mangroves in India: In India mangroves cover an area of 6,700 square kms. The major mangroves are North Andaman and Nicobar, Sunderbans (W. Bengal), Bhitarkanika (Orissa), Coringa (A.P.), Mahanadi Delta (Orissa), Godavari delta (A.P), Gult of Cutch (Gujarat), Coondapur (Karnataka), Achra Ratnagiri (Maharashtra), Lake Vembanad (Kerala), Point Calimere (Tamil Nadu) and Krishna Estuary (A.P). The National Wetlands Management Committee has been expanded to cover mangroves and coral reefs for conservation and management. The following areas are listed in management action plan – setting up biosphere reserves (Ram of Kutch, Gulf of Mannar, Sunderbans, Andaman) declaring National parks and rehabilitation of tribals.

46. WETLANDS OF INDIA

Wetlands Defined: Wetlands are transitional areas between truly aquatic and truly terrestrial ecosystems where the water-table is usually at or near the surface of land. The wetlands are usually covered with shallow water. Examples of wetlands include marshes, bogs, swamps, floodplains, peatlands, tidal marshes, littoral zones of large water bodies and deltaic areas. The three key attributes of wetlands are hydrology (refers to the degree of flooding or soil saturation with water), hydrophytes (the wetland vegetation like water-hyacinth) and hydric soils.

Ramsar Convention: An international convention was held in Ramsar (Iran) in 1971 to provide a framework for International Co-operation for the Conservation and Management of wetland habitats. India acceded to the Ramsar convention in 1982 and six wetlands in India have been declared as wetlands of international importance viz. Chilka, Harike, Loktak, Sambhar Wular and Kaladeo.

Uses of Wetlands:

1. Wetlands are one of the most productive ecosystems. Their water-logged conditions produce a rich collection of plants providing food, fodder and timber. The water-logged conditions are also ideal for cultivation of rice and potential sites for aquaculture.

2. Wetlands support a wide variety of bird and animal life. Many wetlands serve as winter resorts for a variety of birds. For e.g., the Bharatpur bird sanctuary offers habitat for exotic migrants from China, Siberia and Afghanistan. In fact, many rare and endangered species live in and around wetlands as for e.g., the Royal Bengal Tiger in Sunderbans wetland complex. Wetlands are breeding grounds for water fowl.

3. Wetlands can be thought of as nature's kidneys since they absorb toxic chemicals and detoxify/denitrify polluted water. In fact the water-hyacinth abundantly available in wetlands acts as a pollution filter.

4. Wetlands are sinks for carbon. The wetland vegetation is responsible for great intake of atmospheric carbon-dioxide. For e.g., it is estimated that the marshy areas of Salt Lake Town (east or Calcutta) once generated 99,000 litres of oxygen per minute. But ever since the area has been converted into a residential site, the oxygen release went down to 12,000 litres per minute.

5. Wetlands naturally serve in flood control and prevent coastal erosion by intercepting and absorbing run-off waters due to storms. For e.g., the Sunderbans wetland complex prevents storm waters from entering Calcutta.

Wetlands in India: India has a wetland areas measuring 4.1 million hectares. Indian wetlands can be classified into Himalayan. Indo-genetic and Coastal. Indian wetlands are directly or indirectly linked to the river systems.

Measures Taken: The Union Ministry of Forests and Environment has constituted a "National Committee" on Wetlands, Mangroves and Coral Reefs. The committee is expected advise the government on policy guidelines for conservation management and research of wetlands, mangroves, coral reefs and related ecosystems. Earlier, the National Wetlands Management Committee (NWLMC) was constituted to advise the government on policy guidelines for implementing the programme

of conservation, management and research. The NWLMC has identified 16 wetlands in the country for conservation and management on a priority basis. These are Kolleru Lake (A.P.), Wular Lake (J & K), Chilka Lake (Orissa), Loktak Lake (Manipur), Harike Lake (Punjab) Bhuj Lake (M.P.) Lake Sambhar (Rajasthan), Lake Pichola (Rajasthan), Lake Ujni (Maharashtra), Kaladeo National Park (Rajasthan), Kanjli Lake (Punjab), Renuka Lake (Punjab) Sunderbans (W. Bengal) etc. The NWLMC has formulated an action plan for conservation and management of wetlands which includes the following components: a) Survey / demarcation b) Weed and siltation control c) Pollution abatement d) Development of fisheries e) Promotion of environmental awareness for rational use of wetlands. To implement the action plan, state level "Sterring Committee" have been constituted for some wetlands like Wular, Harike, Renuka and Kanjli. The state level steering committees are responsible for survey, notification, weed/siltation control, pollution abatement etc in their respective districts.

47. RENEWABLE ENERGY

The renewable energy resources of India include solar energy, wind energy, hydropower, biomass based power, tidal energy, wave energy and ocean salinity based OTEC power. India receives 5000 trillion KWh of solar energy per year. The Jodhpur-Jaisalmer stretch of Thar desert has been declared as a solar energy enterprise zone for solar energy development. The government has announced a national solar power mission to develop 20,000 mw by 2020. India has a wind energy potential of 45,000 mw and has installed around 10,000 mw capacity. India also has biomass based power potential of 1800 mw and has developed around 700 mw form this potential. India has around 84000 mw of hydro power potential and has installed a capacity of around 37,000 mw. Small hydropower potential of India is around 15,000 mw of which around 2500 mw has been developed. The coasts of India have a tidal energy potential of 8000 mw and pilot plants for tidal power development have been set up at Thangassery (Kerala), Vizhingam (Kerala) and Car Nicobar. The wave energy potential of India's coasts is around 40,000 mw and a pilot plant at Kovalam (Kerala) has been commissioned. Ocean Energy Thermal Conversion (OTEC) which makes use of temperature differences between surface and deep waters has a potential of 50,000 mw and a pilot plant is being set up at Kulashekarapatnam, Tamil Nadu.

48. Anthropogenic Causes For Floods In India

The anthropogenic factors responsible for floods in India are

1. Intense developmental activity in the floodplains of rivers has interfered with the natural flow regimes of rivers in addition to reduction in area of surface runoff. This has exposed new areas to flooding, often unpredictable.
2. The development of canal irrigation in the northern plains has raised the water tables which has restricted downward infiltration of excess runoff during times of heavy rain.
3. Faulty location and faulty designs of bridges, rail routes and roads particularly in hilly and forested regions has led to drainage congestion in river channels hence leading to floods.
4. Indiscriminate deforestation in catchment areas in upper reaches of river courses especially in the Siwalik basin, Assam Himalayas,

Chotanagpur region and shifting cultivation in the northeast has led to accelerated rates of runoff and also excessive siltation of river beds and reservoirs leading to floods.

That human factors have intensified flooding in India is supported by the finding of the National Commission on Floods which declared that the flood prone area in India increased from around 7 million hectars in 1950s to around 30 m.ha today.

49. THE SPATIAL AND THE TEMPORAL CHARACTERISTICS OF SUMMER MONSOONS OF INDIA

The Southwest Monsoon of India has its normal onset on 1st June each year on mainland India having covered Andaman and Nicobar by 25th May. By 5th June, the summer monsoon covers entire southern peninsular India and the Northwest. By 1st July it covers entire landmass of India except northern Kutch and Thar plains and by 15th July it covers entire landmass of India. The landmass of India gets about 78% of rainfall by the summer monsoon. Spatially, the summer monsoon is made up of the Arabian Sea and the Bay of Bengal branches. There are three streams of the Arabian Sea branch which bring rainfall to a major part of Peninsular India and Northwest India except the Aravalli region. The Bay of Bengal branch is made up of two streams which deliver rain to the Northeast and the middle and lower Ganga plains. The Tamil Nadu coast is the rain shadow region for the summer monsoon in addition to a 225 km wide rain shadow region on the eastern side of the Western Ghats.

The two branches of the summer monsoon have their confluence over the Chotanagpur plateau. The summer monsoon begins to retreat on 1st September and the retreat is completed by 15th December. The retreating monsoon brings rain to the Tamil Nadu coast, the Krishna-Godavari delta, to Northeast India and to the region immediately west of the Aravallis.

50. THE GEOGRAPHIC OCCURRENCE OF NUCLEAR MINES IN INDIA

The nuclear minerals of India include pitchblende (uranium oxide), uraninite (for uranium and thorium), monazite (for thorium and uranium) and zircon (for some uranium). These occur in a) black sands of Malabar coast which mainly contain monazite b) the black sands of the eastcoast along Vishakapatanam and Cuttack which have monazite and zircon c) Jaduguda, Dantupa, Narwa Pahar, Bhatin- all in the Singhbhum district of Jharkhand which contain pitchblende for uranium d) new deposits of uranium having discovered in Nalgonda district of Andhra Pradesh, Kylleng-Martabah region of Meghayala. It may be noted that India has the largest reserves of thorium. Small deposits of uranium also occur in Ajmer/Udaipur, Rajasthan and Monghyr /Gaya, Bihar. The black sands along the coast of Ganjam in Orissa have significant deposits of mineral monazite. Monazite also occurs in Jhansi/Lalitpur, Uttar Pradesh and in Madurai in Tamil Nadu.

51. THE GEOGRAPHIC POTENTIAL OF INDIA IN OIL AND GAS RESERVES

About 40% of India's landmass is made up of sedimentary rocks in 17 sedimentary basins which can be potentially hydro-carbon bearing. Another 10 sedimentary basins are in offshore areas which have an extremely large potential for the occurrence of hydrocarbons. The prognosticated reserves in these 27 sedimentary basins are around 28 billion tonnes of which around 7 billion tonnes have been established as in place reserves. About 70% of reserves are in the form of oil and rest in natural gas. The potential for oil and gas is in the deltaic areas of Krishna, Godavari, Cauveri, Ganga and Mahanadi, particularly offshore deltaic regions, in the Thar plains because they represent a former continental shelf, the Indo-Gangetic plains which are young alluvial sediments could also contain hydrocarbon and the Andaman Sea region. The potential in these regions has been validated by the discovery of oil in Andaman Sea, of oil and gas in Barmer and Jaisalmer in Rajasthan in 2004, in Mahanandi offshore areas in 2009 and the established oil and gas deposits in the Cambay basin of Gujarat, the Krishna – Godavari and Cauvery basin and in the Assam basin of North East India.

52. THE IMPORTANCE OF COASTAL SHIPPING IN INDIA'S TRANSPORT SECTOR

Coastal shipping is the movement of goods/people within the territorial waters of India extending upto 12 nautical miles from the coastline. The major and intermediate ports of India on the east and the west coasts serve more than 50 districts which holds enormous opportunities for development of coastal shipping. The importance of coastal shipping in India lies in the following:

a. India's coastline is suited for long distance feeder coastal services for both passenger and freight movement.

b. It is cost-effective and an environment friendly alternative to rail and road. For example, it is 10 times more efficient than roads for the same diesel used and is only $1/8^{th}$ of the cost of road transport.

c. It will lead to the development of an integrated multimodal transport system with an alternative to move cargo, currently being moved uneconomically by road/rail.

d. It boosts coastal trade

e. It will offer the growing number of port based SEZs a cost-effective and efficient alternative mode of transport.

53. THE COMPONENTS AND IMPORTANCE OF COMMAND AREA DEVELOPMENT STRATEGY

Command areas are areas served by irrigation projects. The command area development strategy is to bridge the gap between irrigation potential created and the actual irrigated area due to factors such as inadequate development of on-farm irrigation infrastructure, inability of farmers to change their agronomic practices to suit wet agriculture, inadequate farm extension services in irrigation commands. The components of the strategy are:

a. On-farm development works like land development, development

of field irrigation systems along with equitable supply of water to all farmers in the command

b. Development and adoption of an appropriate cropping pattern suited to wet agriculture

c. Development of rural physical infrastructure in the neighbourhood of commands to support a productive agriculture

d. Maintenance and modernization of irrigation systems close to the farms.

The importance of command area strategy lies in

1. It permits the full exploitation of the productive potential of the farm sector based on irrigation
2. It will lead to efficient cropping systems
3. It will make agriculture productive due to use of modern inputs
4. It will ensure efficiency/equity in use of the water resources
5. It will lead to development of rural infrastructure

54. THE CHIEF POINTS IN THE INTERNAL MIGRATION PATTERNS OF INDIA.

In general, the people of India have low levels of mobility internally. The following are the chief points in the pattern of internal migrations in India:

1. The smaller states have a larger proportion of inter-state migrants compared to the larger states
2. The most dominant class in the internal migration process is rural to urban migration in which female migrants dominate over the males, usually due to relocation following marriage.
3. The second important form of internal migration is rural to urban because of both push and pull factors in which male migrants

dominate over female migrants.

4. The urban to urban form of migration is the 3rd dominant form which involves migrations from towns to cities.

5. The urban to rural migration is the least dominant and where female migrants dominate over males and it is usually due to marriage. The recent focus on rural development, particularly the Mahatma Gandhi Rural Employment Programme has partly slowed down the process of rural to urban migration.

55. AGRO-FORESTRY AND ITS IMPORTANCE IN INDIA

It is a label for a series of land-use patterns on farm lands where permanent trees are grown on farm land with crops and or animals in some planned form of spatial arrangement or temporal arrangement which is mutually beneficial. In Agro-forestry, there is a significant interaction between the woody and the non-woody components on a piece of agricultural land where the interaction can be ecological or economical or both. Sustainable use of land, conservation of resources and increase in productivity of resources are the aims of agro-forestry. Agro forestry includes strategies like agri-silviculture (tree and crop association) or silvi-pastoral system (growing pasture crops with trees) or slivi-agri-sericulture (association of crops with trees that can host silk warms) etc. Agro-forestry assumes importance in India due to continued large scale deforestation, growing demand for timber wood/fuel-wood, increasing livestock population and continued large scale soil erosion. Hence well planned agro-forestry strategies can mitigate these problems.

56. THE MAJOR FACTORS IN THE DEVELOPMENT OF INDIA'S SOUTHWEST MONSOONS

The Southwest or summer monsoon develops due to:

1. The global shift of pressure belts to the north in the summer of the northern hemisphere including the shift of the inter-tropical convergence induces the development of monsoonal circulation. The shift of the ITC is very pronounced in the vicinity of the Indian subcontinent where it is located in the northern plains. This forces the southeast trades to cross the equator and blow over northern Indian Ocean and the Indian landmass as southwesterly winds.

2. The offshore monsoons along the Somali coast lead to upwelling of cold waters and development of the Mascarene high pressure area. The Somali jet stream blows from the Mascarene high towards the West Coast of India strengthening the monsoonal circulation.

3. The heating of Tibetan surface in the summer generates warm air currents which descend into the Indian Ocean to form the Easterly Jet which blows west to join the monsoon winds.

4. The disintegration of the westerly jet over the Himalayan foothills and the adjacent plains by the high Himalayas when the jet moves north in phase with the onset of the monsoon over the northern plains.

5. The tropical easterly jet born close to Sumatra adds to the monsoon winds as it blows towards the coast of Africa.

57. THE CHIEF CHARACTERISTICS OF INDIAN BIODIVERSITY HOT SPOTS

Biodiversity are regions which are unusually rich in species, most of which are endemic to the regions, and under constant threat of being overexploited. India has two of the world's eighteen biodiversity hot spots- The Eastern Himalayas and The Western Ghats. The Eastern Himalayas include Nepal , Bhutan , Parts of China and Northeast India. The region has 9000 plant species with 40% being endemic to the region. It is recognized as rich source of primitive flowery plants and wild relatives of economically important plants. More than 50% of the land mammals are from this region and is also rich in bird species.

The Western Ghat region is one of the richest biodiversity regions and is rich centre of endemism. There atre 1500 endemic species of dicotyledon plants and 315 species of vertebrates. The rare animals of Western Ghat are Lion Tailed Macaque, Nilgiri Longue and Malabar Gray Hornbill.

58. THE CHIEF CHARACTERISTICS OF INDIA'S DESERT REGIONS

I. b) Indian landmass include three kinds of deserts- the hot tropicalThar desert, the salt desert of Gujarat and the cold desert of Ladakh and adajacent portions of Himachal. Thar desert is a typical hot tropical desert within the sub-tropical high pressure belt with vast areas of sand dunes. This desert includes rich reserves of oil-gas , Phosphate ,Gypsum etc. The Thar is drained by the seasonal Luni and is home to around 1200 species of animals. The soils are red desert soil with rich concentration of water soluble salts. The cold desert of Ladakh and Himachal are intermontanne high altitude desert with gray desert soils. In ladakh , the desert has a rugged topography with high altitude plateau and gray desert soils. The Ladakh cold desert include large saline water bodies which are important wetlands Illa Tso Moriri and pongong Tso. The great Salt desert of Gujarat include the great Rann of Kutch which is a marshy region with Mangrove forests, The soils are rich in salt deposits. The region includes the rare species like Asiatic wild ASS and is also nesting ground for Flamingoes.

59. DROUGHTS IN INDIA

Drought is a condition of inadequate availability of water for man, animal and crop. Meteorologically , a condition of drought is said to arise if monsoonal rainfall falls short by 15% of the long period average in a given Meteorological subdivision. While it is true that only one-third of India's land mass gets adequate rain fall , it is also true that the heavy monsoonal rainfall is inadequately captured and stored. To a significant extent, droughts in India are man made in the context of heavy monsoonal rainfall over India and its large number of rivers. The problem of drought is intensified due to

1. Actual irrigated area is around 90 million hectare of the total of 105 million hectare irrigation potential created

2. India's storage capacity of rainwater is equal to 30 days of rainfall in a river basin, very less compared to world standard.

3.Inadequate watershed management and poor rainwater harvesting has led to increase of drought prone atrea.

4. Faulty cropping pattern in different agro-climatic regions inappropriate to their agro-climatic condition has led to frequent crop failures intensifying droughts.

60. THE CHIEF STEPS TO INCREASE INDIA'S ENERGY SECURITY

1) The share of renewable energy in India which is around 9% should be increased with focus on development of solar and wind energy.

2) India should increase exploitation of its hydropower potential which is about 150 GW

3) India should exploit her huge Thorium reserves which if exploited by the breeder reactor route can add 5 Lakh MW of capacity.

4) Indian companies should be encouraged to acquire oil/ gas and coal blocks abroad. The acquisition of coal blocks by NTPC in Madagascar is a step in this direction.

5) India should promote the use of CNG as its operating cost is cheaper by 2/3rd compared to petrol and 1/3rd cheaper than diesel.

6) The exploratory efforts of India for oil / gas should increase as the 27 sedimentary basins of India are inadequately exploited.

7) India should intensify R&D to exploit new sources of energy like coal ded Methane and gas hydrates.

61.THE DIFFERENCES BETWEEN THE COALFIELDS OF PENINSULAR INDIA AND COALFIELDS OF NORTHEAST INDIA

The coalfields of peninsular India belong to the Gondwana rocks of the parozoic era. These are part of Damodar, Godavari , Mahanadi, and Son Valleys..These Gondwana fields contain the principal deposits of bituminous coal of India with some coking coal as in Jharia coalfields. the reserves are large, the coal seams are thick and Gondwana coal has relatively lower ash , Sulphur and volatiles. The coalfields of Northeast India are contained in younger geographical formations of Tertiary age. Hence these are low grade coals of sub-bituminous quality with a high content of ash , volatiles and Sulphur. These Tertiary coal deposits have small reserves and thin seams. The Tertiary coal deposits are mainly in Mikil/ Maibum fields of Assam and Namchilk fields of Arunachal Pradesh.

62. THE GLOBAL BASIS OF INDIA'S SUMMER MONSOON

The Summer Monsoon has a global basis in its origin and mechanism. These are briefly:

1) The global shift of pressure belts brings the I.T.C over the Northern Plains. This induces the Southeast Trades to cross into the northern hemisphere and change into Southwest Monsoons.

2) Global shift in temperature belts to the north in summer of the northern hemisphere leads to heating of Tibetan Plateau, also due to its great height. This triggers the Tibet Easterly Jet which rises in Tibet and sinks over equatorial Indian Ocean to strengthen monsoon circulation.

3) Shift of temperature belts to north in summer of northern hemisphere leads to intense heating of Asia hence giving birth to the seasonal Tropical Easterly Jet which blows from Sumatra towards Arabian Sea, hence strengthening monsoon circulation

4) Heating and cooling of equatorial Pacific can give birth to EL Nino and La Nina conditions which may affect the monsoon.

63. THE POTENTIAL AND IMPORTANCE OF ECO – TOURISM IN INDIA

The climate and geographic diversity of India with diverse ecosystems with their rich ecology gives to it a rich eco – tourist potential. This includes cold and hot desert ecosystems of Ladakh and Thar, the mangrove regions, the biosphere reserves with rich ecology, the coral reef regions of Palk Strait and Lakhshadweep, the ecology rich backwaters of Kerala, the eco – rich zones of the Himalayas etc. The potential also lies in the hospitable climate of India which permits access to these ecosystems throughout the year. Affordability and tourist friendly local communities add to this potential. The importance lies in:

1) Regulated eco – tourism improves the socio – economic well being of local communities.

2) Strengthens conservation efforts and properly planned eco – tourism is one of the most effective tools for long tern conservation of biodiversity

3) Can revitalise traditional arts and crafts of indigenous communities

4) Generates large revenues for local communities hence becomes effective in dealing with poverty/unemployment

64. THE CHIEF CHARACTERISTICS OF GLOBALLY IMPORTANT AGRICULTURE HERITAGE SYSTEMS (GIAHS)

The chief characteristics of GIAH like Koraput would include:

1) A diverse agricultural system with species diversity

2) These have globally significant agricultural biodiversity which not only provide food security to local communities but have implications for global food security. That is, the crop strains in such agricultural systems have the genetic make – up to help develop improved crop varieties for world agriculture.

3) The agricultural systems are compatible with the physical, biological and cultural environment and hence include sustainable conservation practices

4) These systems have communities with a rich reservoir of knowledge of sustainable farming systems, which can provide models of sustainable farming to the world

5) Since they represent co – evolution of Man and Nature, they include practices which can inspire sustainable development practices relevant to the world.

6) They are major centres of origin of important species of crops.

7) They provide useful information on development of mixed farming systems.

65. THE CURRENT POSITION OF INDIA IN DEMOGRAPHIC TRANSITION

India's demographic trends beginning in the census decade of 1991 – 2001 and continuing into 2001 – 2011 shows a clear tendency towards a demographic transition. For example in census decade 1991 – 2001, demographic trends indicated a slowing down of population growth decisively for the first time, unlike in the period between 1951 – 1981 when India was locked up in population explosion stage. In 1991- 2001, states like Tamil Nadu, Karnataka and A.P showed trends of rapid decline in population growth while Kerala and Puducheri had already made the demographic transition i.e., stable and low population growth. In 2001 – 2011 census decade, expect a few states like Bihar, U.P, Rajasthan, M.P and Jharkhand, the trend in other states was a definite slowdown in population growth. That the country is trending towards completion of demographic transition is also indicated by a gradual decline in the Total Fertility Rate (TFR) and a sharp decline in birth rates and infant mortality rates noticed in 2001 – 2011.

66. THE VIABILITY OF THE SCHEME OF INTERLINKING THE INDIAN RIVERS

The scheme of interlinking of rivers conceived in two components, Himalayan and Peninsular, is to add 35 million hectares as additional irrigation potential, add 34 GW of additional power capacity, control floods / drought and improve dryland agriculture. The main issues in the viability are:

1) Interlinking includes construction of some large dams, world experience including India's experience with large dams has clearly demonstrated that
   a) They are not effective in flood control
   b) By promoting flood irrigation, can cause water logging / soil salinisation and hence may negate gains of irrigation led agriculture
   c) Big dams undergo rapid siltation of their reservoirs hence do not last their planned life, hence do not justify cost – benefit analysis

2) Inter – basin transfer is the most expensive method to transfer water and improve agriculture as demonstrated by such schemes which failed in Turkey and USA

3) Will have the potential to create serious adverse ecological imbalances like deforestation, water logging

4) The estimate of surpluses in India's river basins are only rough approximations as run – off of rivers varies seasonally and hence the surpluses may not be surpluses after all

5) There is no clear quantitative estimate of the amount of water to be transferred from one basin to another, hence the infrastructure created to utilise surpluses may not be fully utilised

67. THE FACTORS RESPONSIBLE FOR CLOUDBURSTS IN INDIA

A cloudburst is an episode of heavy rainfall delivered in a short spell, usually amounting to more than 100 mm of rain per day. The mechanisms involved in cloudbursts in India are:

1) Intense convection in summer due to intense heating of the landmass promotes the development of thunderstorms in May and June in the Northern Plains and portions of peninsular India leading to heavy rainfall and flash floods.

2) In the hilly forested regions of India, particularly in summer months, convective activity is intensified due to high water availability in these regions. This can lead to cloudbursts like the Ladakh cloudburst in 2010.

3) Depressions and tropical cyclones of the Bay Bengal in late summer months of September to November can bring sudden stormy conditions leading to cloudbursts in east coastal regions

4) The heating of landmass, particularly in the Northern Plains during the monsoon season can trigger convection cells which can intensify the monsoon rainfall leading to heavy rainfall like heavy monsoon rain in Mumbai in 2005 (which recorded around 37 Cms of rain in a single day in the monsoon season)

5) The abrupt onset of monsoon winds as part of their onset in different regions can lead to sudden spells of heavy downpour as in Kerala

68. THE CHIEF CHARACTERISTICS OF INDIA'S BIO – GEOGRAPHIC ZONES

India's 15 Bio – geographic zones, accounting for 8 % of global biodiversity include the following characteristics:

1) They include tropical, temperate and desert ecosystems
2) They represent elements from Afro – Tropical, Indo – Malaysian and Paleo – Arctic bio -geographic realms
3) These have a high degree of endemism of species

4) The Bio – geographic zones of India include two of the 18 biodiversity hot spots of the world (the Western Ghats and Eastern Himalayas. The Western Ghats have been recognised as one of the 8 hottest of the biodiversity hot spots with large species diversity and high degree of endemism of species.
5) The Thar desert Bio – geographic zone has nearly 1200 animal species
6) The Bio- geographic zones include special ecosystems like coral reefs, the salt marshes of Kutch, the mangroves like Sunderbans.

69. REGIONS OF INDIA ARE EXPOSED TO THE THREAT OF DESERTIFICATION

A 8) Desertification is land degradation in semi – arid to arid tropical regions due to both natural and anthropogenic factors. The threat of desertification is serious in:

1) The areas in the vicinity of Aravallis which is primarily due to mining of phosphate and gypsum besides overgrazing by livestock in this fragile ecosystem

2) Large areas in the Rann of Kutch are exposed to this hazard due to expansion of agriculture (i.e., animal husbandry and some hardy crop agriculture) and salt mining

3) The Badlands of Chambal basin are exposed to intense ravine and gully erosion which has already turned them into wastelands which could easily turn into a desert

4) The forested regions on the fringes of Aravallis are exposed to desertification due to deforestation.

5) The fragile ecosystems of the rainshadow regions of peninsular India (like the region east of Western Ghats in A.P and Karnataka) face this threat due to intense agricultural activity

The Vidharba region of Deccan Plateau is exposed to this hazard due to intensive agricultural activity

SHORT NOTES

Glacial Lake Outburst Flood: These develop due to rapid melting of glaciers, attributed to global warming, which develops rapidly growing lakes from the meltwaters which abruptly move downslope causing floods

Footloose Migrants in India: Footloose migrants are unskilled labour who do not have a definite region for in – migration and move haphazardly in search of livelihood, mostly made up of people from rural areas which have suffered agricultural collapse.

McMahon Line: Henry McMahon Line is the border between India (in Arunachal Pradesh and Sikkim) with Tibet of China, which was agreed to between India, China and Dalai Lama of Tibet in the 1913 – 1914 Shimla conference.

Tidal characteristics of India's West and East Coast: Tidal amplitudes systematically increase from lower to higher latitudes along both the West and the East coasts, leading to highest tidal amplitudes at Kandla and Kolkata compared to Tuticorin. The tidal amplitudes are higher along the west coast as Arabian Sea is a true ocean unlike the partially enclosed character of the Bay of Bengal

Badlands of India: These are in the Chambal basin of the Malwa plateau which have developed gullies and ravines due to intense soil erosion in this semi – arid climate region. These Badlands have been rendered into wastelands.

Intensive and extensive agriculture: Intensive agriculture is irrigated agriculture with widespread use of chemicals and high yielding varieties of seeds. It also has either no fallow or small fallow period and usually the land is under multicropping . Extensive agricultureis more environment friendly with reasonably long period of fallow , lesser intensity of cropping , irrigation to only supplement rainwater and low intensity in use of chemicals and high yielding variety. Extensive agriculture does no hazards like water logging, soil salinisation and soil toxicity

Earthquakes and tectonic plates: Plate tectonics theory declares that the earth's lithosphere occurs in the form of tectonic plates and that the motions of such plates are responsible for the world pattern of earthquake and volcanic activity. The motions of the tectonic plates are also responsible for development of fold mountains. The motions of tectonic plates create plate boundaries which are either convergent, divergent or neutral. Along all these boundaries two adjacent plates move relative to each in convergent, divergent or slip motion. These plate motions cause earthquake and volcanic activity along the plate boundaries. Hence volcanic and earthquake belts follow plate boundaries

Soil horizons: soil horizons are the distinct horizontal layers within the soil. These horizons differ from each other in colour , content of humus and plant nutrients, the soil particle size and relative age. The horizons develop from rock and mineral fragments over a long period of geographical time. The collection of all the soil horizons makes up the soil profile. The typical horizons are 'O' or the organic horizons , 'A'-the top soil horizon , 'B'- sub-soil horizon , C- which is rock fragments or sometimes bedrock

Causes of ocean tides: The alternate global rise and fall in the level of the sea is the ocean tide. The ocean tide are due to gravitational pull of the Sun and Moon on earth and also due to the centrifugal force due to earth's rotation. The tides are semi-diurnal i.e. , two high tides and two low tides in some locations or diurnal i.e., one high and one low tide in other locations. The ocean tides have well defined temporal and spatial pattern. The tides create tidal flats in coastal plains which in turn become excellent sites for mangroves and also help man in certain areas like ship navigation and tidal energy based electric power.

New uranium mines of India: The new deposits and mines of Uranium in India are parts of Dharwar rocks. These include the Banduhuraang mines in Jharkhand, the Tumullapalli mines in Kadapa (AP) , the Peddagattu mines in Nalagonda(AP) , the Domiasiat and Mawtabah mines of Meghalaya and some small new mining areas in karnatka.The new Uranium mines based on recent discoveries have increased India's reserves of uranium enormously and making India one of the world's leading countries in uranium reserves.

Indian Ocean Dipole: The Indian Ocean Dipole is the Indian Ocean component of the El Nino of the Pacific Ocean which has been discovered by Japanese scientists. The Indian Ocean Dipole plays an important role in influencing the summer monsoons of the India during El Nino years.

Truck farming: Truck farming is a variety of agriculture that evolved in Western Europe. In truck farming, perishable agro items like fruits and vegetables are grown within a truckable distance of a large city i.e. , the distance over which trucks can easily transport the perishable to the major urban markets. Truck farming is well developed in Western Europe and North America and today involves not only the cultivation of fruits and vegetables but also dairying.

Ria coasts of India: Ria coasts are varieties of submerged highland coasts. In such coasts, mountain and their valleys are partly submerged under sea water and are also perpendicular to the shore line. The Ria coasts therefore develop deep inlets of sea into land. India has the Ria coast type of coast in portions of the Konkan coast , particularly the Konkan coast off Goa. Hence the Western Ghats i.e., the Sahayadris are perpendicular to the coastline and at places are also partly submerged under sea water

Run-off- the-river project : Run-of-the-river project is a hydro power dam making use of the natural flow of the river and its drop in height to produce

electric power

Biodiversity Hotspot: A bio-diversity hot sport is a region rich in biodiversity where the biodiversity is endangered either directly or indirectly due to Man's activities. The Sahyadris and the northeastern Himalayas are two biodiversity hotspots.

Tabletop Airports: A Tabletop airport is an airport with the runway located on a hilltop or a plateau top which descend abruptly along their sides, like the Mangalore airport

Green water : This is water held in the different layers of the soil profile i.e. water held in the A, B and C horizons of the soil layer.

Coral Triangle: A region of Pacific Ocean which has a rich collection of coral reefs, the region is surrounded by Indonesia, Malaysia, the Philippines and New Guinea.

Ecological Footprint : Refers to the human demand for natural resources in a given region, larger the footprint more endangered are the natural resources.

Shale Gas : Methane gas contained in the sedimentary rocks called Shales, which is extracted via the fractures in these rocks as a source of commercial natural gas.

Arctic Oscillation: Fluctuation in atmospheric circulation in the arctic, when it is positive a ring of strong winds circle north pole which act as a barrier to contain winds in polar areas, if negative the cold winds spread to lower latitudes.

Strawberry belt of India: India's biggest region for the cultivation of strawberries and is in the Mahabaleswar region of Maharashtra.

Cartagena Protocol : : is on biosafety, evolved in 2003, to monitor the movement of genetically modified organisms.

Desert National Park of India : is part of the Thar desert of Jodhpur, home to the Great Indian Bustard and is tentatively in the UNESCO world heritage list.

Mention two Austric languages of India: The two largest groups within the Austric language family are the Munda group of languages (Santhali, Mundali) and the Mon-khmer languages which includes Khasi and Nicobarese

Badlands of India: These are regions with a large number of gullies/ravines cut by short streams in a semi-arid climate with thick soil and represent severe soil erosion. Are found in Chambal badlands of Malwa.

Cherry Blossoms: These are the pre-monsoon showers of Karnataka which are due to intense heating of the landmass throughout summer and hence leading to convectional rain

Green GDP: Is a tabulation of the natural resources consumed for a given output of GDP and hence represents the environmental cost of economic growth

Dandakaranya region: A tribal forested region in parts of Orissa (Kalahandi, Bolangir) and Chhattisgarh (Bastar and Bailadilla) inhabited by the Adivasis and which is also mineral rich

Indus Suture zone: is in Ladakh, represents the region where the Indian plate has fused with the Eurasian plate and is marked on the surface by the presence of volcanic rocks

NPK ratio: This is the ratio of nitrogen (N), phosphorus (P), and potassium (K) in fertilizers, which are the three major plant nutrients and the ideal NPK ratio is 4:2:1.

Agro forestry: This is scientific integration of agriculture with horticulture, silviculture, pisciculture and sericulture which is mutually beneficial to the crops and these activities.

Duars : These are the valleys across the Darjeeling hills of West Bengal and are the gateways of India to Bhutan.

Gas hydrates: These are ice-like crystals of methane found on the sea floor and are considered to be a major future source of methane gas as a commercial fuel.