

Agriculture

Different Agricultural types

- (1) **On the basis of supply of land:** Intensive agriculture and Extensive agriculture
 - ❖ **Intensive method** is practiced where the supply of land is limited and density of population is high. China, Japan, India, UK, Holland, Germany and Belgium practice this method.
 - ❖ **Extensive method** is practiced in sparsely populated area - where per man land area is higher and where there is scope for bringing additional land under cultivation e.g. USA, Russia, Australia, Argentina and Brazil.

- (2) **On the basis of supply of moisture:** Humid farming, Irrigation farming and Dry farming.
 - ❖ **Humid farming** is practiced where there is no dearth of rainwater for the production of crops. Problems of water logging and drainage and soil erosion are present in the heavy rainfall areas.
 - ❖ **Irrigation farming** is practiced in those areas where rainfall is seasonal and the amount is not satisfactory for crop production. In the river valleys of the world this farming is practiced.
 - ❖ **Dry farming:** areas having very little rainfall less than 50cm and very little irrigation facilities practice dry farming. Crops which can bear the high cost of production e.g. cotton and wheat is grown under this method.

The types of farming practised are discussed below:

- A. **Shifting cultivation:-** A primitive form of agriculture practiced mainly in the tropics wherein a plot of land is cultivated for a few years, until the production declines due to soil exhaustion. Slash and burn method is practiced in which forests are cut and burnt nutrients are returned to the soil. On the interval few years the process is repeated and this a cycle is formed in the long run.

Different local names of shifting Cultivation:	
Ladang	Malaysia
Chengin	Philippines
Milpa	Central America & Mexico
Rocha	Brazil
Masole	Zaire & Central Africa
Jhum	N.E. India
Ray	Vietnam & Laos

Fang	Equatorial African Countries
Logan	West Africa
Conuco	Venezuela
Tongya	Myanmar
Chenna	Sri Lanka
Tamarai	Thailand
Huma	Java & Indonesia
Jhum	N.E. India
Bewar	Bundelkhand
Deepa	Bastar
Jara & Erica	Southern States
Batra	South-eastern Rajasthan
Podu	Andhra Pradesh
Kumari	Western Ghats in Kerala
Kaman, Winga & Dhavi	Orissa

B. Plantation farming:- An estate farming mostly in tropical and subtropical regions devoted to large scale production of one or more cash crops e.g. Coffee, Rubber and Tea, etc.

C. Truck farming:- Refers to the intensive cultivation of vegetables for the market and therefore is corresponding to the term market gardening that is usually done in U.K. Truck farms, however, appears to be more specialized and truck farms are generally situated farther from the markets.

D. Mixed farming:- It refers to the combination of agriculture and livestock farming.

E. Collective farming:- A type of agricultural organization started in former USSR and then adopted in Eastern Europe, China, N. Vietnam and N. Korea. Large farms covering thousands of hectares are managed by co-operative bodies and the govt. and called Kolkhoz and Sovkhoz respectively. The workers receive shares of the sale proceeds as wages, according to the work done.

- F. Nomadic Herding:-** It's a type of shifting pastoral farming in which pastoralists move from one place to another in search of good pasture. It is mainly practiced in arid and hilly regions and primitive societies. Animals like Cattle, sheep and goat are reared for milk, meat, wool etc.
- G. Transhumance:-** It is also concerned with animal husbandry but in this the people have their permanent settlement and they move to a suitable place only in adverse climatic condition and return back to their homeland as the climatic condition becomes normal. Mountains of Himalayas, Rockies, Alps and Norway are famous region for transhumance. In India Gaddis of Himachal Pradesh and Bakarwals of J&K practice transhumance.

Food Grains

- I. Wheat:-** Wheat is the dominant grain of world commerce and is the staple food of millions of people. It is also an important part of the daily diet of many millions more. The world wheat market is enormous. Annual global wheat consumption is in excess of 550 million tonnes (20 billion bushels).

Conditions of Growth

- A minimum temperature of 16°C and bright sunshine for ripening, and 100 frost free days.
- A mild moist season with annual rainfall ranging between 50 cm and 100 cm.
- A relatively stiff, preferably loamy and nonacidic soils.
- Level or slightly rolling lands to facilitate mechanical methods of farming.

In terms of net output four countries viz. Russia, U.S.A., China and India contribute over 50% of world production. But temperate countries like France, Spain, Argentina, and Australia are also important contributing most (20%) of world's wheat.

Distribution of Wheat:

USA: According to regional diversity of climate four major wheat growing belt can be distinguished they are:

- White wheat region of the Colombian plateau;
- Hard red spring wheat of the N provinces;
- Hard red winter wheat of the W and S provinces, and
- Soft red winter wheat of the Southern states.

Russia: The wheat production is concentrated in black chernozem soil belt. They are

- The north Caucasus region producing winter wheat in the south-western part and
- The Volga region of the spring wheat
- The eastern regions including trans-Ural and western Siberia producing best hard spring wheat in the world.

Australia: The important wheat growing areas are in the fertile plains of Murray Darling basin and in the S.W. Australia. Uncertainty of rainfall, great distance from markets and low population are main deterrents.

Argentina: Wheat farming is confined to the great wheat crescent which is bounded to the west by the 40 cm isohyets and to the east by the 100 cm isohyets lines.

Export:-

USA, Canada, Argentina and Australia are leading exporting countries whose share is almost 80%. Britain, Japan, Germany, Belgium, Holland, Italy are leading importers.

II. Rice

Rice is normally grown as an annual plant, although in tropical areas it can survive as a perennial crop for up to 30 years. The rice plant can grow to 1-1.8 m tall, occasionally more depending on the variety and soil fertility.

Conditions of growth

- i. Hot and humid climate - high degree of temperature ranging between 20°-27°C and minimum rainfall 120 cm. It also requires water logging particularly in the early parts of its growth and deep clayey loams.
- ii. Rice needs a level surface to ensure annual flooding of the fields. It's most ideal habitat is therefore, the great riverine flood-plains of the world.

Distribution:- Monsoonal low lands of South-east Asia is the most outstanding region for rice growing in the world-accounting for 85% of the total rice acreage of the world and produce 90% of the world output. The noted rice producing countries in the world include China, India, Indonesia, Bangladesh, Thailand, Vietnam, Myanmar, Italy, Spain, USA and Brazil are other producing countries.

China:- China is also the largest producer of rice in the world. Sichuan basin is the largest producer followed by Red Basin, riverine flood plain of Yangtze basin, Yunnan and Kweichow provinces, Fukien, Kwanghing and Kwangsi and Hunan, Kiangsi and Chungking province. The soil fertility, use of manures and unified management are responsible for higher productivity.

India:- India the second longest producer of rice in the world.

Bangladesh:- is the third largest producer of rice, though rice is grown everywhere Dacca, maymansingh, Bakharganj, Faridpur, Barisal districts account bulk of the country's output.

Japan:- rice is grown throughout the country; per hectare production is very high. But high domestic demand and limited land forces the country to import rice.

The fertile alluvial plains of Irrawady in Myanmar, the Red Basin of North Vietnam, the Mekong Basin of South Vietnam, and the Menam Basin of Thailand are also notable in rice production Rice is also grown in Nile valley and delta of Egypt, S.E. Brazil and Gulf of Mexico in the USA and Po river valley in Italy.

Export:- Very meager amount of rice (2 to 5%) come to the international market. The major rice exporting countries are China, Myanmar, USA, Thailand, Brazil, India and Italy. Major importing countries are Indonesia Korea, Hongkong, Srilanka and Bangladesh.

III. Maize

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. The United States produces (42.5%) of the world's harvest; other top producing countries includes China, Brazil, Mexico, Argentina, India and France.

Conditions of growth:- No other cereal is cultivated under such diverse climatic conditions and no other cereal crop is so widely distributed both in tropical and warm temperate latitudes. Even then favorable conditions are:

- i. Temperature 20-25°C
- ii. Long and warm summer with considerable rainfall followed by little rainfall of autumn and cold winters is ideal and optimum conditions
- iii. Rainfall 7-15 cm per month and during season of 130 to 170 days.
- iv. Deep rich soils of the sub-tropical latitudes with high nitrogen content well drained plain lands are most commonly preferred for maize growing.

Distribution:

USA, Brazil, Mexico, China and Russia account for 65% of the total world maize production. USA accounts for half of the world's maize production. The Corn Belt extends from central Ohio to Central Nebraska. Iowa, Illinois, Indiana, Minnesota, Pennsylvania and Nebraska are the principal maize producing states of the USA. In this belt maize is grown as rotation crop.

China is the second largest producer

Brazil - Minas Gerais, Sao Paulo, Rio Grande are important maize producing zone. The production almost double of Argentina but consumed locally.

Export: 16 per cent of the total global output enters world market is sale. Argentina, USA, France and South Africa are major exporting countries. Japan is the largest buyer, followed by Netherlands, Italy, Spain, UK, Germany and Denmark.

IV. Barley

Barley is a widely adaptable crop. It is currently popular in temperate areas where it is grown as a summer crop and tropical areas where it is sown as a winter crop. Its germination time is anywhere from 1 to 3 days. Barley likes to grow under cool conditions but is not particularly winter hardy. Barley is more tolerant of soil salinity than wheat

Conditions of Growth

- i. A moderate amount of rainfall 75-100 cm.
- ii. Short growing season, resistant to a number of conditions, grown on lands which are not used for rice/wheat short supply of moisture led barley to be grown in further forward to the pole in the north and high on the high monitions slope.

Distribution:- Russia is the largest producer of barley in the world. No other can causes is the most important producing zone. China is the second largest producer of barley.

Export:- USA & Canada export 60% of the world barley Argentina, Denmark and France are other exporters. Germany, UK, Japan and Netherlands import almost half of the world's barley.

V. Oats

Oats are the hardest of all cereals. It is almost confined to northern hemisphere. The oats are of paramount importance in the old damp countries like Greenland, UK, Sweden, Norway and grown in a significant proportion by the countries of Central and Eastern Europe. Russia is the largest producer of oats followed by the USA, Canada, Germany, France and Poland.

VI. Rye

Rye is essentially a European agro-product and is grown primarily in Eastern, Central and Northern Europe. The main rye belt stretches from northern Germany through Poland, Ukraine, Belarus, Lithuania and Latvia into central and northern Russia. Rye is also grown in North America (Canada and the USA), in South America (Argentina, Brazil), in Turkey, in Kazakhstan and in northern China.

VII. Sorghum

USA is the largest producer of Sorghum, in China Sorghum is called Kaolin. In China, sorghum is fermented and distilled to produce maotai, which is regarded as one of the country's most famous liquors.

VIII. Millet

Millets are major food sources in arid and semi-arid regions of the world and India is the largest producer of millets in the world.

IX. Cotton

The largest producers of cotton, currently (2009), are China and India, with annual production of about 34 million bales and 24 million bales, respectively; most of this production is consumed by their respective textile industries. The largest exporters of raw cotton are the United States

Conditions of growth

- i. Uniformly high temperature 20-25°C during the growing period.
- ii. A frost-free season of 100-200 consecutive days.
- iii. Annual rainfall ranging between 60-90 cm. during the maturing period higher rainfall is detrimental.
- iv. Well drained fertile soils with high water retentive capacity.
- v. Plentiful supply of cheap labour.

Distribution:

The crop is quite widely distributed in the sub-tropical latitudes and a host of countries are sub-tropical latitudes and a host of countries are engaged in its production, but a few countries viz. Russia, USA, China, India, and Egypt dominate the output.

USA:- The area to the S.W. of Mississippi river enjoys the overwhelming superiority in cotton cultivations. Texas, Oklahoma and Arkansas are also important cotton producing states. USA is the second largest producer of cotton in the world.

Egypt:- is the producer of the best quality cotton in the world. The reasons for importance of raw cotton in the world are (i) highly suitable climatic and edaphic condition (ii) high demand for Egyptian long staple cotton; (iii) long experience in cotton mixing. Egypt accounts for 60-70% production of long staple cotton in the world.

Export:- The leading cotton producing nations like the USA, Egypt, Mexico, Brazil, Peru, Sudan, Pakistan and Turkey are all leading exporters of cotton in the world. The countries alone account for 50% of the world's export. Japan is the single largest buyer of cotton in the world.

X. Jute

Jute is a rain-fed crop with little need for fertilizer or pesticides. The production is concentrated in Bangladesh and some in India. The jute fibre comes from the stem and ribbon (outer skin) of the jute plant. The fibres are first extracted by retting.

Conditions of growth

- i. A hot and humid climate with a minimum temperature of 28°C and more than 200 cm of rainfall with 80 to 90% humidity especially during the season.
- ii. Cheap and plentiful supply of labour is another contributing factor.

India, Bangladesh and China account for almost 98% of the world's jute production.

Distribution:

Bangladesh - Jute is the most important cash crop in Bangladesh and is grown in almost all the districts. The jute belt of Maymansingh, Decca and Tippera and the old valley of Brahmaputra is noted for very higher grade of jute. On the banks of river Jamuna, Pabna, Bogra and Rangpur district are also famous. Maymansingh is the largest producer of jute in the world.

China - is the largest producer of jute in the world. Jute producing regions are principally located to the south of Yangtze Kiang river the important provinces are Guangdong, Zhejiang, Guanik, Jiangu and Hunan.

India - is one of the largest producers of the jute in the world.

Apart from these countries, Russia, Brazil, Myanmar, Thailand and Nepal are also growing jute.

Export:-

Bangladesh:- is the largest exporter in the world, contributing 65% of the world's export. India (5%), Nepal and Thailand are other exporters. U.K., Germany, Japan, Pakistan and Spain are important importers.

XI. Flax

Flax is an erect annual plant growing to 1.2 m (3 ft 11 in) tall, with slender stems. In the United States, three states, North Dakota, South Dakota, and Minnesota, raise nearly 100% of this plant. It is used for manufacture of linen, is produced from seed from which linseed oil is extracted.

Conditions of growth

- i. Grows in areas having moderate rainfall distributed evenly during the growing periods warm and uniform summer temperature with high humidity are required for the growth of plant.
- ii. Clay loam soil so as to be able to retain moisture.
- iii. Constant weeding is required in order to. Like jute it requires rotting

Distribution:- Practically all the flax fiber is produced in Europe, Russia, Poland, France, Belgium, Holland and Czech Republic are the principal producers.

Russia:- Russia is the largest producer. More than 80% of the world's flax comes from Russia. Khabarovsk and Smolensk are the chief areas of production. Poland, France and Belgium's place come accordingly in production after Russia.

XII. Hemp

Hemp is one of the faster growing biomasses known, producing up to 25 tonnes of dry matter per hectare per year, and one of the earliest domesticated plants known. For a crop, hemp is very environmentally friendly as it requires few pesticides and no herbicides.

Conditions of growth

- i. Moderate rainfall, well distributed over growing period of 110 days warm conditions and high humidity.
- ii. Well prepared and fertilized soil and
- iii. Large supply of labour

Kursk, Ukraine and Monrovia are important producing areas. Italy produces the best quality hemp, in the Po river valley and volcanic plains in the south. India, Yugoslavia, Rumania, Hungary Poland and Spain are other notable producers of hemp in the world.

XIII. Silk

Silk is a natural protein fiber, some forms of which can be woven into textiles. The best-known type of silk is obtained from cocoons made by the larvae of the mulberry silkworm *Bombx* more reared in captivity. The birth place of silk is China as from there it spread to Japan, India, Southern Europe and Western Asia.

Commercial production of silk involves four different stages: (a) growing of mulberry trees (b) rearing of silk (c) tendering of cocoons (d) reeling of silk.

The temperature should be between 20-30°C each cocoon has 762 to 915 meters of filament. For the ideal growth of cocoon, high temperature and heavy rainfall is required. The mulberry trees can be grown on poor acid and infertile soils. This is why they are relegated to the rugged lands or hilly tracts which are not available for food production.

Distribution:

Japan:- is leading producer of silk in the world the production is taking place from northern Honshu to South Kyushu. The great concentration of production is in Lake Suwa region of Central Honshu - high temperature heavy rainfall and rugged topography is easily available.

China:- Production is centered in south and west of Shanghai, in parts of Szechwan basin, in the delta region of Si-Kiang near Canton. Shantung Peninsula also participates in production.

Korea:- the relief, soil and climatic conditions favors the growth and throughout the country it is the subsidiary occupation of the farmers.

In Europe:- PO valley of Italy is famous for silk production. France is also important.

India:- is the only country where all four types of raw silk are produced- Mulberry, Eeri, Tusser, and Muga.

Export:- Japan is the largest exporter contributing more than 70% followed by China, Korea and Italy. USA is the largest country importing more than 60% followed by UK, France, and India.

XIV. Tea

Tea is the agricultural product of the leaves, leaf buds, and internodes and is the most popular drink in the world in terms of consumption. Its consumption equals all other manufactured drinks in the world - including coffee, chocolate, soft drinks, and alcohol - put together.[4] Most tea consumed outside East Asia is produced on large plantations in India or Sri Lanka.

Conditions of growth

- i. High temperature of 27°C abundant rainfall of about 200 cm and high amount of moisture in the air. This climatic condition confines the cultivation in rainy tropical and humid tropical regions. High humidity, heavy dews and morning fog favors rapid development of young leaves.
- ii. Relatively high sloping ground - so as to prevent water logging in the plant and should contain iron content acidic in nature.
- iii. Large and cheap labour supply.

Distribution:

These environmental and economic features are present in South and East Asian countries and hence more than nine-tenth of production comes from there continuously. More than 75% of the global output of tea comes from India, China, Srilanka, Japan and Indonesia. Outside the realm of monsoonal Asia. The tea is grown in USSR Kenya, Malawi and Turkey.

India:- is the largest producer of tea in the world.

China:- Chief production areas are lying between the Yangtze and Sinkiang valleys. Red soils of the hilly areas of the provinces of Hunan, Anhui, Sichuan, Zhejiang and Fujian are important producing states. China has the largest area under tea cultivation in the world. China is the largest producing green leaf tea in the world.

Srilanka:- Tea states are highly concentrated in the Nuwara Eliya and the Badulla areas. In small quantity of tea is also grown in Kandy and in the hills behind Gale and Malara. Srilanka is the second largest exporter of tea in the world.

Japan:- Tea is grown mostly on the Pacific coast on the low terraced slopes of the mountains enriched with highly fertile volcanic soils. Uji and Shizuoka districts of southern Honshu are most important tea growing areas.

Indonesia:- In Java island, the production is concentrated the slopes of two extinct volcanoes Godak and Salak on the western side. In N.East part of Sumatra tea is also grown.

Taiwan:- is known for its wuling tea. The terraced fields around Taihoku are important tea growing areas.

Kenya:- is an important producer outside the monsoonal realm. There tea is grown on the Nairobi high lands Malawi, Mozambique at Tanzania are other producing countries in Africa.

Export:- India and Srilanka are first and second largest exporter of tea in the world followed by Indonesia, Bangladesh, Japan and Kenya. European and American countries are major importers e.g. U.K., USA, Russia, Australia, Canada, Netherlands and Pakistan.

XV. Coffee

Coffee is a brewed drink prepared from roasted seeds, commonly called coffee beans, of the coffee plant. They are seeds of coffee cherries that grow on trees in over 70 countries. Coffee is usually propagated by seeds. The traditional method of planting coffee is to put 20 seeds in each hole at the beginning of the rainy season

Conditions of growth

- i. Warm climate conditions annual range of temperature is between 21° and 26°C and winter temperature should not fall below 10°.
- ii. High rainfall ranging between 125 and 150 cm. The hot rainy season helps the plants to grow rapidly and dry winter seasons favors the proper ripening and harvesting.
- iii. Well drained fertile, soil rich in plant nutrient such as iron and potash are useful. Terra Roxa soil is ideal for coffee plant. The plant grows usually on hill slopes and highlands having in altitude of 1800 to 2500 ft.

Distribution:-

Four major coffee producing regions in the world are:

- South American:-** region comprising Brazil, Columbia, Ecuador and Venezuela and Peru - account for 50% of the world's production.
- Caribbean Region:-** Mexico and Al Salvador, Guatemala and Costa Rica - 15% of the world production.
- Africa:-** including Uganda, Ivory Coast, Angola, Ethiopia, Malawi, Congo and Kenya - contributes 30% of world output.
- S.E. Asia:-** comprising Indonesia Indian and Philippines - 5% of the total output.

Brazil:- Four states of Sao Paulo region Parana, Espirito, Santos and Minas Gerais are leading producers. Good soil and good drainage condition and intensive network of transportation apart from the favorable climatic conditions favor the concentration in this region. Brazil is the largest producer and exporter of coffee in the world.

Columbia:- is the second largest producer. The great majority coffee estates are located with in the high mountain slopes of the Andesaround Bogotá, Madellin, Manizales and Tolima are the principal centers of the regions.

African Countries:- The rainy uplands, rich fertile soils and favorable climatic condition in addition to abundant supply of cheap labor lead to the rapid increase in output in recent years. Ivory Coast is the third largest producer of coffee in the world.

Export:- More than 80% of total output enters the global trade market. Brazil, Columbia, Ivory Coast Uganda and Mexico are the chief exporting countries. USA, Germany, France, Italy, the Netherlands and Japan are the main buying countries. USA is the largest importer of coffee.

XVI. Cocoa

Cocoa is essentially a tropical crop, is best developed in the regions having about 27°C of temperature and 200 cm of rainfall. It requires deep clay soils rich in iron and potash and cheap labor supply is also significant.

Distribution:- West African countries of Ghana, Ivory Coast, Cameroon and Nigeria are the most important Cocoa producers in the world accounting for more than 70% of the world production, rest of the production come from South American countries including Brazil, Ecuador, Venezuela, Dominican Republic and Mexico. Ghana is the largest producer and exporter of cocoa is the world-contributing half the country's export earnings. Cocoa cultivation is concentrated in the form of a triangle which includes the three important towns of Accra, Kumasi and Takoradi.

Nigeria - Important Cocoa growing regions in the country are concentrated around Ibadan in S.W. Nigeria which has the largest acreage.

Brazil is the largest South American producer of cocoa. Bahia distt in N.E. Brazil is the most important region. Ecuador - most of the cocoa growing areas are concentrated in the Guayaquil Lowlands which provides almost optimum climatic condition for cocoa growing.

Papua New Guinea is the most important producer of cocoa of Oceania contributing a little over 2% of world production.

Export: The West African countries viz. Ghana, Ivory coast, Cameroon and Nigeria are more or less solely dependent on the earning from the exports of cocoa, Ghana is the largest exporter followed by Nigeria, Brazil and Ivory coast, USA is the largest importer followed by UK, Germany and Netherlands along with France, Japan, Belgium and Italy.

XVII. Sugarcane

Sugarcane growing countries of the world are lying between the latitude 36.7° north and 31.0° south of the equator extending from tropical to subtropical zones.

Condition of growth

- i. Warm climatic conditions the annual temperature ranging between 21-27°C
- ii. It grows best in the regions having about 125 cm of annual rainfall. If the amount of rainfall exceeds the optimum level, the sucrose content declines.
- iii. Deep, well drained fertile soils are most important for sugarcane cultivation water logging is highly detrimental.
- iv. Sugarcane growing is, highly labor intensive in nature. Therefore, densely populated tropical countries are most imported for sugarcane cultivation.

Distribution:-

Sugarcane is most widely grown in a number of tropical and sub-tropical countries but the two principal sugarcane areas are (i) South-east Asia-India, Pakistan, China, Indonesia and Thailand and (ii) Latin America - Cuba and Brazil.

China:- contributes about 6% of the world's sugarcane rugged Terrain limit the cultivable areas only to river basins.

Indonesia:- cane is most intensively a cultivated in the Java islands where the climoedaphic economic condition is ideal.

India:- is the largest producer of cane in the world.

Pakistan:- produces a little over 4% of the world output - cultivation is mainly concerned in irrigated plains.

Brazil:- produces more than 15% of the world output and comes next only to India – due to suitability of environmental conditions. The principal area of concentration include (a) the coastal lands of the north-east in the states of Parahiba, Peruamnbuo, Alagoas and Bahia (b) The Minas Gerais district and (c) the coastal plains North-east of Rio-de-Janerio.

Cuba:- its economy is to a great extent dependent on sugarcane cultivation - is the third largest producer of sugarcane in the world. The favorable environmental and economic conditions led the concentration in the districts of Havana, Metanzas, Orienta and Santa Clara. Nearness to vast American market is an added advantage.

Australia:- Produces little over 4% of the world's sugarcane cultivation predominates along the east coastal plains of Australia stretching from northern New South Wales to North Queensland. Queensland is the most important producing state.

Mauritius:- and Fiji is two important islands, countries grow sugarcane mainly for exports and their economy is based on cane cultivation.

Cropping Season in India

India has many growing seasons due to prevalence of high temperature through a long period. Different crop seasons are:

- (a) **Kharif:-** Crops are sown at the beginning of the South -West monsoon and harvested at the end of the South -West monsoon.
Important crops:- Jowar, bajra, rice, maize, cotton, Jute, groundnut, sugarcane, tobacco etc.
- (b) **Rabi:** Crops need relatively cool climate during the period of growth but warm climate during the germination of their seed and maturation.
Sowing season- (October -December) and harvesting season (February - April).
Important Crops:- Wheat, barley, gram, linseed, mustard, masur, peas and potatoes.
- (c) **Zaid:** Crops which are being raised throughout the year due to artificial irrigation.
 - i. **Zaid Kharif:-** Sown in August-September and harvested in December-January. Important crops include rice, jowar, rapeseed, cotton and oilseeds.
 - ii. **Zaid Rabi:-** Sown in February - March and harvested in April -May. Important crops are watermelon, cucumber, leafy and other vegetables.

Total geographical area of India: 328.7 m. ha.

Total New sown Area: 140.27 m. ha. (46.12%)

Total Net Irrigated Area: 38.80 m. ha (27.66% of net sown area).

In Eastern India, east of 80° East meridian and in the coastal lowland (West coastal lowland south of Surat) rice is the dominant crop. Tea and jute are distinctive crops of eastern India. West of 80° East meridian and north of Surat, wheat is the dominant crop. 100 cm Isohyet is the major dividing line.

Jowar, bajra, pulse, groundnut and cotton are the chief crops in the Indian Plateau and wheat, various pulses, cotton, mustard, jowar, bajra, etc. in the alluvial plains of Uttar Pradesh, Haryana and Punjab.

Types of Farming

1. **Shifting Cultivation:** Prevalent in the forest areas; cultivation is done over the burnt forests which are abandoned when fertility dwindles. It has different name indifferent states. **Main crops:** dry paddy, wheat, maize, sugar cane etc.
2. **Sedentary or Settled Cultivation:** Mainly confined to plateau and highland areas. **Main crops:** Sugarcane, Oilseeds, Cotton.
3. **Capitalist Farming:** Practised on large holdings called, farm estates. It is highly capital intensive type of agriculture. **Main crops:** plantation crops.

Description of crops

● Rice

It covers about 25% of the total gross cropped area of the country.

Climatic Conditions:- Rain fall more than 125 cm.; clayey loam soil is best suited; average monthly temperature should not fall below 21°C as in Orissa, West Bengal, Bihar, Assam and South India.

Area: Coastal India (south of Bombay on the western coast), Eastern India, Chhattisgarh Plain, Wainganga valley, alluvial plain of West Bengal, Mahanadi delta, eastern Assam valley, Cauvery delta.

In West Bengal rice is grown in 3 different agronomic seasons-

1. Aus, sown in Feb-March,
2. Aman, sown in March-April &
3. Boro, sown in June.

In terms of production as % of total rice production, West Bengal ranks first followed by T.N., U.P., Andhra Pradesh, Punjab & Bihar.

In terms of yield (kg/ha), Tamil Nadu ranks one followed by Punjab, Andhra Pradesh and Karnataka.

● Wheat

It covers about 14% of total cropped area of the country.

Climatic Conditions: Cool climate; 30 cm. rainfall during the growing period; clayey alluvial is the best suited soil; raised mainly in area of rainfall annually less than 100 cm.

Crops: (1) **Common bread wheat**-Most common in the Indo-Gangetic Plains; the major part of total wheat produced in India. (2) **Durum/ Marcaroni wheat**-Susceptible to yellow rust; most common in the north-western India and the black soils of Indian Plateau. (3) **Emmer/Triticum Dicocum wheat**-Produced in Karnataka, Tamil Nadu and Maharashtra. (4) **Indian dwarf wheat**-Produced in limited areas of M.P. and U.P.

About 70% of total wheat area in India is under irrigation.

About 40% of total wheat area in India is rainfed.

In terms of area as a percentage of total area under wheat, UP ranks one followed by MP, Punjab, Rajasthan, Bihar and Haryana.

In terms of production as % of total wheat production in India, U.P. ranks one followed by Punjab, Haryana, Bihar.

In terms of yield (kg/ha) Punjab ranks one followed by Haryana, West Bengal, Rajasthan, Uttar Pradesh.

• Barley

For the growth of barley the climatic conditions are the same as for wheat. However it can well thrive even in more cool climate as its potential area is much wider than the wheat.

Barley is used for the production of malt which again is used for brewing beer and other alcoholic products.

In terms of production as % of total barley production in India, Uttar Pradesh ranks first followed by Rajasthan, Haryana, Punjab.

Points to Remember

1. India ranks 7th in the world in terms of total geographical area but 2nd in terms of cultivated land.
2. India has total geographical area of 328.7 million hectares out of which 142.60 m hectares is the net sown area. It is about 46.59%. Arunachal Pradesh has only 3.2 percent area under net cultivation while in Haryana and Punjab it is 82.20 percent.
3. In Punjab, more than 94% of the total cropped area is irrigated.
4. In India, out of the net cropped area of 142.82m hectares, only 55.14 million hectares (38.5%) are irrigated.
5. India stands next only to China in the production of rice contributing 21.5 percent of the world population.
6. Bengal is the largest rice producing state contributing to more than 14.6% of the rice production of India, but in term of yield per hectare Punjab and Haryana occupy the top rank.

7. Soviet Union, United States and China are the countries which produces more wheat than India. In term of production U.P. ranks first while in terms of yield Punjab ranks first in India.
8. India is the second largest producer of sugarcane after Brazil and it has the largest area under sugarcane cultivation.
9. India grows 7% of the total world production of tobacco which is next only to China, U.S.A and Brazil.
10. Kerala is considered as the “spice state of India”.
11. “Harrison” and “Virginia Gold” are the high yielding varieties of tobacco.

Climate of India

Climate

Climate can be classified on the basis of temperature, precipitation, evaporation and their seasonal characteristics. The classification scheme of W. Koppen is the most popular system and universally accepted. A classification of the world climatic types is given ahead:

1. Tropical Rain Forest/Equatorial Forest Type

Extent: 5°N to 5°S; Amazon Basin, Zaire Basin, Malaysia, Indonesia.

Average daily temperature: 25°C throughout the year

Annual range of temperature: Less than 5°C

Daily range of temperature: Less than 10°C, due to high % of cloudiness.

Rainfall: Convectional, throughout the year. No dry season.

Annual rainfall: 150 to 200 cm.

Characteristics: Hot wet condition throughout the year favours rich vegetation.

2. Tropical Grassland/Savanna Type

Extent: 5°N to 15°N & 5°S to 15°S; Africa, East & central S. America, Transitional zone between Monsoon and desert climates of Australia.

Monthly mean temperature: 32°C in summer and 20°C in winter.

Annual rainfall: 50 to 100 cm.

Characteristics:- Distinct dry season in winter. Rainfall is in summer owing to convectional ascent of air.

They have tropical grassland with scattered trees.

Llanos: Colombian Highland.

Campos: SE highland of Brazil,

Granchaco: Argentina & Uruguay.

Savanna: Australia and Africa.

3. Tropical Monsoon Type

Extent: South-east and East Asia, N. Australia, India, Myanmar, Thailand and South China.

Annual range of temperature is greater in the interior than along the coast.

Annual rainfall may exceed 150 cm. along the coast

Characteristics: Strongly developed dry season and the rainfall of the driest month is less than 6 cm. Great contrast in temperature between summer and winter.

4. Tropical Deserts

Extent: Western margin of the continent; N. America- Colorado Desert, Mexican Desert; Africa - Sahara & Kalahari Desert; S.W.- Asia - Arabian, Iranian & Thar Deserts; S. America- Atacama Desert; Australia- Great Australian Desert.

Mean monthly temperature is 36°C in summer and 15°C in winter.

Diurnal range of temperature is very high.

Annual rainfall: It is a region of descending air so precipitation is scanty. It remains very hot during the day (45°C) and quite cool at night (15°C). Annual rainfall is less than 20 cm.

5. Mid-Latitude/Temperate Deserts

Extent: Tibet, Mongolia, Gobi, Patagonia, Parts of Soviet, Central CIS.

Average annual temperature: above 18°C

Rainfall: scanty.

Charactereristic: Winter is colder because of its interior location. Some are intermountain deserts.

6. Tropical Dry-hot Steppe

Extent: N.Australia, Arabia, Rajasthan, Deccan Plateau, S.African Plateau, North Argentina.

Annual rainfall: 30 cm, maximum in summer.

Charactereristic:Climate is semi-arid characterized by grasslands.

7. Mid-Latitude Dry-cold Steppe

Extent: Ukraine W. Siberia, Western U.S.A

Annual rainfall: less than 30 cm, maximum in summer.

Charactereristic:It has semi-arid climate with grasslands.

8. Mild Humid Climate with no Dry Season/West European Type

Extent: South of 45°S, Western margin between 45°N and 60°N; N.W.-Europe including British Isles, west coast of Canada, S.Chile, Southern New Zealand, Tasmania.

Rainfall of driest month: more than 3 cm.

Monthly mean temperature: 5°C in winter and 15°C in summer.

Annual range of temperature: 10°C. Winters are milder than the similar latitude in the eastern margin of the continent.

Annual rainfall: 75 to 100 cm. No dry Season as the westerly winds blow from the ocean throughout the year. Rainfall is mostly of cyclonic origin.

9. Mild-Humid Climate with a Dry Winter/China Type

Extent: Along the eastern margin of the continent in sub-tropical belt; 25°-35° in both the hemispheres; Central China, S.E.-USA, South Bengal; Eastern Argentina, S.E.-Africa, S.E.-Australia, S-Brazil, S-Japan.

Annual rainfall: 100 cm, maximum in summer. Warmest summer month has ten times more rainfall than the driest winter month. Winter is a dry season as in winter, cold winds blow from the interior landmass. These areas are exposed to tropical cyclones.

10. Mid-Humid Climate with Dry Summer/Mediterranean Type

Extent: 30° to 45° L on western side of the continent in both hemispheres; Around the Mediterranean sea, in S. Europe, N. Africa, California coast, Central Chile, Cape of Good Hope, S.E. -Australia

Rainfall of driest month of summer: less than 3 cm. Winter is the wettest month; 70% rainfall in the 6 winter months.

Monthly mean temperature: 20°C in summer and 10°C in winter.

Annual rainfall: 40 to 90 cm only in winter (Cyclonic rainfall).

Off shore trade winds blow in summer; they are dry and give no rainfall.

Local winds like Sirocco, Mistral, Boro are prevalent.

11. Snowy Forest Climate with moist Winter/Taiga

Extent: beyond 60° N in Europe, Asia and N. America.

Annual rainfall: 30 to 40 cm; both in winter and summer; No dry season.

Characteristics: Summers are short and warm, warmest month temperature is 10°C to 15°C. Winter are long and severe, coldest month temperature below -3°C. Have coniferous forest vegetation.

12. Snowy Forest climate with Dry Winter/Manchurian Type

Extent: Eastern Siberia, Northern China, Part of Japan, Korea, N.E. -USA, E-Canada,

Temperature range is 20°C in summer and 5°C in winter

Annual rainfall: 50 cm. to 75 cm. Summer is the season of rainfall, winter is dry.

Vegetation consists of mixed forest of deciduous and coniferous trees.

13. Tundra Climate

Extent: Arctic Ocean coast, Iceland, Greenland

Mean temperature of the warmest month: 0°C to 10°C

Vegetation: Mosses, Lichens.

Annual range of temperature: 40°C to 50°C

Annual rainfall: 20-25 cm.

Characteristics: Summer is short, ground may be snow free. During long winter soil moisture freezes and snow covers the land totally.

14. Perpetual Forest Climate/Ice-cap Type

Extent: Antarctica, Greenland.

Temperature is always below 0°C, throughout the year.

Winter- continuous night and summer-continuous days

15. High Mountain Type

Extent: On high mountain slope of both hemispheres. Himalayas and Andes have vertical zonation of climate from tropical to ice-cap type. Windward slope receives heavy rainfall while the leeward sides are dry. In the N-Hemisphere southern slopes are warmer.

Climate of India

The climate of India is broadly, of the tropical monsoon type. The word monsoon (Arabic: Mausim) stands for seasonal reversal in the wind pattern and accounts for and is associated with the rhythm of season, changes in the direction of winds, distribution pattern of rainfall and temperature with the change of seasons. However, the regional variations in climate can't be ignored. These variations are expressed in terms of winds, rainfall, temperature and humidity. Main factors deciding the local climate are location, altitude and distance from general relief.

Mechanism of Indian weather

India has wide regional variations in terms of winds, rainfall, temperature, humidity etc. These differences in local climate are produced by the following factors:

- I. Surface distribution of pressure and winds;
- II. Upper air circulation caused by factors controlling global weather and the inflow of different air masses and jet streams; and
- III. Inflow of western disturbances and tropical depressions into India creating weather phenomena leading to rainfall.

Seasons

On the basis of monsoonal variation, there are four seasons in India.

- (a) **The Cold Weather Season:** (December to February): Mainly felt in North India – an important event of the season is the inflow of the depression from the west to the north-west. These low pressure systems, called Western disturbances, originate in West Asia and travel towards India causing some rain and snowfall in winter months in north and north-eastern India.

The temperature increases from north to south. The isotherms run parallel to the latitudes. 20° isotherm runs east-west through the middle part of India. By the mid-December in the northwest India a series of shallow cyclonic disturbances is observed. The rainfall is mostly confined to Punjab & Haryana Plains, North-east Rajasthan, Kashmir and western U.P. In northern India it is very useful for Rabi crops.

(b) The Hot Weather Season (March to May):

Because of the heating of the subcontinent, the equatorial trough moves northward and lies at 25°N in July. This trough attracts surface winds from South - Westerly direction along the West Coast and from north, north - Westerly direction along the Bengal Coast. The northward shift of equatorial trough and the excessive heating of the Himalayan and the central Asian highlands are responsible for generating the monsoon, the influx of monsoon in mid - June changes the season to the rainy one.

Tornado-like dust storm of Punjab and Haryana; the “Andhis” of U.P. and the “Kalbaishakhis” of West Bengal involving strong convection movements causes some precipitation. The “Norwesters” (Kalbaishakhis of West Bengal) originate over the Chotanagpur Plateaus and blow in the north east direction which bring about 50cm of rainfall in Assam and about 10cm rainfall in West Bengal and Orissa. This rainfall is very useful for Assam Tea and spring rice crops of West Bengal.

Similar thunderstorm causes about 25cm rainfall in Karnataka which is locally called as “Cherry Blossom”, beneficial to the coffee plantation and “Mango Showers” elsewhere in South India, which are of salutary effect on the mango crop. “Loo”, a hot wind blows in the northern plain during May and June, with the temperature range of 45°C to 50°C.

(c) The South - West Monsoon Season (June to September):

The ‘monsoon burst’ brings about the sudden onset of rain on different dates in different parts of India. The Arabian Sea current covers West Coast, Maharashtra, Gujarat and parts of Madhya Pradesh, whereas the Bay of Bengal current strikes the Bengal coast and the Shillong plateau and moves West and north -west, parallel to the Himalayas and brings rain to Bihar, U.P., Delhi etc. The two currents merge over Punjab. The tropical depressions, which periodically occur, cause dry spells during the monsoon season. So these depressions determine the amount of rainfall. The East Coast of India remains dry during this season of June -September, since it is in the rain shadow area of the western current and is parallel to the Bengal current.

The normal date of onset of the S.W. -Monsoon is 20th May in Andaman and Nicobar Island, 1st June on Kerala coast and by 15th July it covers whole of India. The withdrawal of monsoon is much more gradual process than its onset. Normally it withdraws from north-west India by the beginning of October and from remaining part of India by the beginning of December. Out of the total moisture brought by the monsoon, only 20 percent is precipitated in India.

Arabian Sea branch causes the first monsoonburst over the Kerala coast normally by 5th June and later on causes heavy rain along the western coast, while the large part of Deccan lies in a rain shadow of the Western Ghats and receive decreasing amount of rainfall. The Arabian Sea branch does not bring much rain to Gujarat and Rajasthan mainly due to absence of a mountain barrier, but gives moderate to heavy rainfall in the foothills of Western Himalayas, Eastern Punjab and North-eastern Rajasthan. The Arabian Sea branch is much more powerful than the Bay of Bengal branch.

The Bay of Bengal branch after crossing the deltaic region enters the Khasi Valley and entrapped within it due to funnel shape of the region and strikes Cherrapunji in a perpendicular direction causing heaviest rainfall near “Mawsynram” (1143cm). A series of depression are originated at

the head of Bay of Bengal and travel in a north westerly direction across central and northern India causes heavy rainfall along their tracks, with the frequency of 2 to 4 depressions per month from June to September.

- (d) **The North - East Monsoon (October to December):** The retreat of South-West monsoon from North India starts in September and is gradual. During this season, severe cyclonic storms develop in the Bay of Bengal which moves in a South-easterly to North-Westerly direction. They give substantial amount of rainfall to the East coast and sometimes cause havoc in Andhra Pradesh, Tamil Nadu and West Bengal. In Tamil Nadu and surrounding areas, it is known as the north east monsoon period.

Generally the withdrawal of monsoon starts from 1st September in the north-western India and is completed in mid December from Southeastern coast of Tamil Nadu. With the migration of Sun towards the south, a high pressure centre begins to build up over the landmass and there is a gradual weakening and withdrawal of monsoon. The retreating monsoon causes rain in the coastal tracts to the south of Krishna delta and the interior of the southern districts.

Climatic Regions of India

The climatic division of India is based upon Trewartha's scheme, which is a modified form of Koppen's system and it corresponds with the vegetative, agricultural and geographical regions of India. Main climatic regions of India include:

- (i) **Tropical Rain Forest (Am):** It is found on the West coastal plain, the Western Ghats and some parts of Assam. It is characterized by high temperature in winter not below 18.2°C; and in summer about 29°C. The average rainfall exceeds 200 cm.
- (ii) **Tropical Savanna (Aw):** It is located in peninsular region except the semi - arid zone in the leeward side of the Sahyadris. It is characterized by long dry weather throughout winter and early summer and high temperature (above 18.2°C). Annual rainfall varies from 76 cm in the west to 150 cm. in the east.
- (iii) **Tropical Semi-arid Steppe (BS):** Prevails in the rain-shadow belt running southward from Central Maharashtra to Tamil Nadu in the leeward side of the Sahyadris and Cardamom Hills. It is characterized by low rainfall which varies from 38 cm to 80 cm, high temperature between 20°- 30° C.
- (iv) **Tropical and Sub-Tropical Steppe (BSh):** Occurs over Punjab extending to Kutch region. The Thar Desert is in the west and the more humid climate of the Ganga plain and the Peninsula to its East and South respectively.
- (v) **Tropical Desert (BWh):** The area includes the western parts of Barmer, Jaisalmer and Bikaner district of Rajasthan. A large portion of Kutch Peninsula along with Thar Desert is also included. It is characterized by scanty rainfall (30 cm. average) with few parts receiving 12 cm annual rainfall. Temperature is above 35° C.
- (vi) **Humid Sub-tropical with Dry Winter (Cwa):** The area includes South of the Himalayas, East of the tropical and sub - tropical steppe and north of tropical Savanna. It is characterized by rainfall of 63.5 cm to 254 cm most of which is received during the South West Monsoon season.
- (vii) **Mountain Climate (H):** The area lies above 6000 metre sea-level. Examples are the Himalayan and Karakoram ranges. Temperature decreases with altitude. The Trans –

Himalayan region particularly Ladakh has a dry and cold climate - what may be called cold desert. Drought is permanent.

Variability in the rainfall

The average annual rainfall in India is 100cm. However, this rainfall is neither uniformly distributed throughout the country nor certain to occur every year. The unpredictable nature of the annual rain poses a major problem for India. But, there are certain regions of heavy rainfall in India which are almost certain to get the annual rainfall of more than 200 cm every year. These are Assam and its neighbourhood, the Western Ghats and the adjoining coastal areas and foothills of the Himalayas. In contrast, certain areas, particularly western Rajasthan, Kutch, Ladakh Plateau are perpetually drought - prone, the average annual precipitation being about 100 cm.

Points to remember

- 1) The position of mountain ranges and the direction of the rain bearing winds are the two main factors that determine the climate of India.
- 2) The chief characteristic of India's climate is the alternating seasons.
- 3) "Growing Season" is that part of the year when the growth of vegetation is made possible by the favourable combination of temperature and rainfall. The length of the growing season is determined by the number of frost free days.
- 4) The "North - East Trade Wind" blows from the continents to ocean.
- 5) In March, the highest day temperature of about "38°C occurs in Deccan Plateau.
- 6) In March, Rajasthan has very high temperature of "45°C".
- 7) In Kerala and Western coastal land, the pre-monsoon showers are known as "mango shower"
- 8) "Kalbaishakhi", which is accompanied by thunderstorm, strong wind and heavy rainfall, occurs in Assam and West Bengal.
- 9) "Loo" refers to hot, dry wind that blows in northern plains. It is very common in Haryana, U.P, Punjab and Bihar.
- 10) During SW monsoon, the bulk of the rainfall is received in every part of India except Tamilnadu.
- 11) It is the relief of the region which determines the amount of rainfall in any region.
- 12) The "South - East Trade Wind" from the southern hemisphere are drawn into India as the south - west monsoon winds which after they cross the equator.

Drainage System & Patterns

The origin and evolution of any drainage system in a particular region are determined and controlled by two factors- (a) Nature of original surface and slope (b) Geological structure.

Streams or drainage systems are divided in two broad categories-

I. **Sequent Drainage System**

- a. **Consequent Stream:** The upland forms the catchment area of rivers, where precipitation is heaviest and where there is a slope down which the run off can flow. The initial stream that exists as a consequence of the slope is called the consequent stream. Most of the streams, draining the coastal plains of India are of this type.
- b. **Subsequent Stream:** When the master consequent stream is joined by its tributary at right angles, it is called subsequent stream. For example, the river Son, a tributary of the Ganga is a subsequent stream.
- c. **Obsequent Streams:** The stream which flows following the direction of the slope opposite to master consequent stream. For example the Mahabharata Range of Lesser Himalayas has originated several streams from its northern slope which join the subsequent stream from the direction opposite to the consequent stream e.g. Sun Kosi runs west to east as obsequent stream and the master consequent streams like Ganga and Yamuna flow in the opposite direction.
- d. **Resequent Streams:** Such streams follow the direction of master consequent stream and meet the subsequent streams at right angles.

II. **Insequent Drainage System:** The streams which do not follow the regional slopes and drain across the geological structures are called insequent or inconsequent streams.

- a. **Antecedent Drainage:** The stream which originated before the upliftment of the surface on which they flow. For example, Indus, Sutlej, Alaknanda and Brahmaputra are antecedent rivers as they originated before the upliftment of Himalayan ranges.
- b. **Superimposed Drainage:** It is formed when the nature and characteristics of the valley and the flow direction of a consequent stream, developed on the upper geological formation and structure, are superimposed on the lower geological formation of entirely different characteristics. For example the river Subarnarekha is superimposed on Dalma Hills of Chhotanagpur Plateau of Jharkhand.

Drainage Patterns

- 1. Dendritic Drainage:** A drainage pattern consisting of a single main stream with tributaries, resembling the branches of a tree. This pattern develops perfectly where the underlying rocks are of a uniform type and the structures are simple.
- 2. Trellis Drainage:** It is a rectangular pattern of river channels. It may develop where a slope is crossed at right angles by the strike of alternating hard and soft rock strata. Long streams develop along the soft rock strata and the short streams follow the slope.
- 3. Radial Drainage:** Here the streams radiate from a central peak or upland mass in all directions. Dome structures commonly develop radial drainage as in the English Lake District of England. The entire drainage network of Sri Lanka, Hazaribagh Plateau, Panchet Hills and Maikal Range are of such type.
- 4. Rectangular Drainage:** A pattern of drainage consisting of two main directions of flow at right angles to one another. This pattern is common where the streams follow the fault lines.
- 5. Annular Drainage:** Here streams follow roughly in circular pattern. Such patterns are usually produced on domed structures where the rivers follow the outcrops of weaker beds of rock in an alternating band of hard and soft beds.
- 6. Parallel Drainage:** A pattern in which the main streams and tributaries follow virtually parallel courses. This develops where there is a strong structural control in one direction or where strata are gently dipping.
- 7. Barbed Drainage:** In this pattern the tributaries flow in opposite direction to their master streams. The tributaries join their master streams in a hook-shaped bend. Such pattern is generally developed due to river capture.
- 8. Centripetal Drainage:** When the streams converge at a point, which is generally a depression or a basin they form centripetal or inland drainage pattern.
- 9. Herringbone Drainage:** When the consequent streams are developed in the longitudinal parallel valley while the tributaries, after originating from the hill slopes of the bordering parallel ridges, join the longitudinal consequents almost at right angle, it is known as herringbone pattern or rib pattern. Jhelum River in the Vale of Kashmir receives many tributaries from both the sides, following the rib pattern.

Industrialisation

Levels of Industrialization best reflect the level of economic development in a country. Manufacturing is the main process by which industries convert primary goods into secondary products by means of value addition, which involves partial or complete transformation of the same. The location of industries is an important theme in geographical studies. It depends on both geographic and anthropogenic factors.

Geographical Factors: Raw material, Power, Labour, Transportation, Market, Site, Water Supply, Climate.

Non-Geographical or Anthropogenic Factors: Capital, Policies, Organization, Banking & Insurance.

Another Set of Factors: Agglomeration effect, Industrial inertia.

Textile Industry

It includes cotton, jute, wool, silk & synthetic fibre textiles. Highest employment in manufacturing sector is found in textile industry (Cotton, Jute, Wool, Silk).

A. Cotton Textiles

It is the most important industry in terms of employment and production of export goods.

Although Maharashtra and Gujarat are the chief centres, other important states in this field are Tamil Nadu, West Bengal, Madhya Pradesh, Karnataka and Andhra Pradesh. Tamil Nadu has the largest number of cotton textile mills in India.

- Indian Cotton mills produce more yarn than woven clothes. More than 50% of yarn is spun from short and medium staples.
- Fine and super-fine yarns are produced in Mumbai, Ahmedabad and Delhi from imported long staple Egyptian and American varieties.
- In yarn production Maharashtra ranks first followed by Tamil Nadu and Gujarat.
- In terms of number of mills Tamil Nadu ranks first followed by Gujarat, Maharashtra, West Bengal, U.P., Karnataka and Andhra Pradesh.
- In India, 58% cloth is of medium variety, 36% of coarse variety and 6% of super fine variety.

Maharashtra: Mumbai (Cottonpolis of India), Sholapur, Pune, Nagpur, Jalgaon, Kolhapur, Akola, Dhulia, Wardha, Satara,

Gujarat: Ahmadabad (Manchester/Boston of India), India, Kalol, Rajkot, Navasari.

Tamil Nadu: Coimbatore, Chennai, Madurai, Tirunelveli, Tuticorin, Salem.

U.P.: Kanpur, Modinagar, Moradabad, Aligarh, Agra, Etawah, Hathras, Saharanpur, Bareilly, Varanasi.

W. Bengal: Kolkata, Howrah, 24-Pargana, Serampore.

M.P.: Gwalior, Indore, Mandsaur, Dewar.

Karnataka: Devanagiri, Hubli, Bellary, Gokak, Mysore, Bangalore.

B. Jute Textile

India manufactures the largest quantity of jute goods in the world. Mainly located in West Bengal, followed by Andhra Pradesh, Bihar, U.P. and M.P.

India is the leading producer of jute products. First mill was established in 1854 at Rishra. There are at present 73 jute mills in India out of which West Bengal has 59 mills, Bihar 3 mills, Uttar Pradesh 3 mills, Andhra Pradesh 4 mills and Assam, Orissa, Tripura and Madhya Pradesh one each.

West Bengal: Titagarh, Jagatdal, Howrah, Ballygunj, Agarpara, Rishra, Serampore, Naihati

Andhra Pradesh: Chitvalshah, Nellimaralla, Eluru, Guntur, Ongole

U.P.: Kanpur, Shahjahanpur,

Bihar: Katihar, Muktapur

C. Silk Textile Industry

India ranks second after China in the field of silk production. There are four types of silk: Mulberry, Tasar, Eri and Muga. All the four Silk varieties are produced in India. Due to stiff competition from Italy and Japan the growth of Industry is very sluggish. India is also the second largest producer of Tasar after China. India has also a monopoly in Muga and Assam is the only producer. The first modern silk factory was established in 1932 at Howrah.

Karnataka: The state produces 52 per cent of the Silk cloths in India. It produces about 70% of nation output and only produces Mulberry. The main centres are Bangalore, Mysore, Kolar, Mandya, Tumkur, Belgaum and Coorg.

W. Bengal: Next important state, Bengal produces only 13 per cent. Mostly mulberry is produced. Production areas are Malda, Murshidabad, Virbhum, Bankura. Famous centres are Bishnerpur, Baswa, Raghunathpur, Chak-Islampur.

Assam: Third largest producer of no-mulberry silk and only Muga producing area. Production centres-Goalpara, Kamrup, Nowgong.

Jharkhand: Mostly Tasar is produced. Production: Palamau, Ranchi, Hazaribagh.

Bihar: Bhagalpur.

J&K: Mostly Mulberry is produced. “Tabby” white plain silk.

Production: Anantnag, Baramula, Doda, Jammu, Udhampur.

Orissa: Tasar producer. Varanasi and Mumbai are the main silk weaving center.

D. Woolen Textile Industry

The modern woolen textile started with the establishment of ‘Lai Imli’ at Kanpur in 1876. It was followed by Dhariwal in 1888 & Mumbai 1882. At present 625 big and small mills, 1,100 hosiery mills & 155 yarn spinning mills are running in India.

Punjab leads all other states in production. It alone has 42% of the mills of India. Dhariwal is the largest center in India. Others are Amritsar, Ludhiana & Khariar. Maharashtra is the Second largest producer of woolen textiles. Mumbai is the major center. Shahjahanpur, Mirzapur, Varanasi, apart from Kanpur are the major woolen textile centers. Jamnagar, Ahmedabad and Vadodara are important centres in Gujarat as per Panipat, Faridabad and Gurgaon in Haryana and Bikaner, Alwar, Bhilwara etc. in Rajasthan.

Punjab: Dhariwal, Amritsar, Ludhiana, Ferozepur (India largest trading centre of raw wool).

Maharashtra: Mumbai (India’s largest centre)

U.P.: Kanpur, Mirzapur, Agra, Tanakpur.

Gujarat: Jamnagar, Baroda, Ahmedabad.

Karnataka: Bangalore.

W. Bengal: Kolkata.

J&K: Largest producer of handloom and power loom woolen goods including coarse tweeds, lohis, shawls, pattus.

Rajasthan: Pushkar and Ajmer produce handloom coarse blankets. Charu (Public sector mill)

Sugar Industry

It ranks second amongst the major agro-based industries. India ranks first in both area and production if both Gur and Khandasari are included.

In sugarcane production U.P. ranks first followed by Maharashtra, Tamil Nadu, Karnataka and Andhra Pradesh.

In sugar production Maharashtra ranks first followed by U.P., Tamil Nadu, Karnataka and Gujarat.

In Gur production U.P. ranks first followed by Karnataka, Tamil Nadu and Andhra Pradesh.

Maharashtra contributes over one-third of country’s sugar output (36 per cent) followed by

Uttar Pradesh with 25%, Tamil Nadu and Karnataka are the other two important sugar producing states in the country. At Present, there are 465 installed sugar factories in the country (as against 138 during 1950-51) of these 244 are in co-operative sector. There has been record production of sugar during year 1999-2000, 182 lakh tonnes.

Iron and Steel Industries

Iron & Steel industry is the basis of modern industrialization. It is the basic and core industry upon which many other industries survive. Per capita consumption of iron & steel is a good measurement of Industrial development. For the first time in 1874 pig iron was produced successfully by Bengal Iron Works. The first modern iron & steel industry was established in 1830 at Porto Nova in Tamil Nadu. It proved to be an abortive attempt. The real beginning was made in 1907 at Sakchi (Jamshedpur) by opening the TISCO.

Iron & Steel Plants and Inputs Sources

Plants	Iron-Ore	Manganese	Limestone	Coal	Power
TISCO Jamshedpur (Singhbhum Distt) on Kharkai river	Gurumahisani (Mayurbhanj) Noamundi (Singhbhum)	Joda (Keonjhar) Noamundi	Sundergarh, Birmitrapur	Jharia, West Bokaro coalfield	DVC
IISCO Burnpur, Hirapur, Kulti	Gurumahisani, Gua, Chiria	Keonjhar	Birmitrapur	Raniganj, Jharia	DVC
VISL (Shimoga dist, Karnataka)	Kemangundi area (Chikmanglur dist.)	Local	Bhundi Guda	Use of electric Furnace due to lack of coal	Sharavati HEP, Mahatma Gandhi HEP.
HSL Rourkela (on Brahmani River)	Sundergarh, Keonjhar	Barajamada	Purnapani; Birmitrapur	Bokaro, Jharia, Talcher, Korba	Hirakud HEP
HSL Bhilai (Durg)	Dalli-Rajhara	Balaghat, Bhandara	Nandini	Korba and Kargali	Korba Thermal Power
HSL Durgapur (on Damodar river bank)	Bolani, Gua	Keonjhar	Birmitrapur, Hathibari	Jharia, Raniganj	DVC
BSL Bokaro (on the confluence of Bokaro & Damodar)	Kiriburu	Barajamada	Palamau Birmitrapur	Jharia, Kargali	DVC
Salem	Locally	-	-	Neyveli	HEP
Vishakhapatnam	Bailadila	Balaghat	Nandini	Damodar Valley & Imported	
Vijayanagar (Bellary dist, Karnataka)	Bababudan Hills			Kanhan valley Singareni (A.P.)	Tungbhadra HEP

Locational Factors: Since this industry used heavy, weight loosing & huge quantity of raw material, the localization is primarily controlled by the availability of raw materials. Therefore, they are either located near the coalfields or iron ore mining areas or at the mean distance from the two. For example, the industries located in Jharkhand, Chhattisgarh, West Bengal and Orissa. A new trend of localization near ports has been set up by the installation of Vijay Nagar Plant and Vishakhapatnam Plant in A.P. for export proposes.

Aluminium Smelting

It is next only to I & S in terms of usefulness in the modern industries. About 50% of the total Aluminium in India is consumed in the generation & distribution of electricity. The other important requirements are utensils and domestic wares (20%), transport (12%), Packaging (8%).

Aluminium Smelting Plants & Their Input Sources		
Plants	Bauxite	Power
Korba (Bharat Al. Co. Ltd, BALCO) Bilaspur Distt., Chhattisgarh	Amarkantak Plateau (Shahdol Dist)	Korba Thermal Power
Renukoot (Hindustan Al. Co. Ltd., HINDALCO) Mirzapur dist.- W. Bengal	Plateau	Amarkantak Own
Belgaum (Indian Al. Co. Ltd., INDALCO) Karnataka	Chandgad (Kolhapur Dist)	Sharavati HEP.
Mehur (Madras Al. co. Ltd.)	Shevaroy Hills	Mettur HEP
Ratnagiri (Bharat Al. Co. Ltd.) Maharashtra	Kolaba, Kolhapur, Satara	Koyna HEP
Damanjodi and Angul (National Al. Co. Ltd, NALCO) Orissa	Pachpatmali	Captive thermal power Power Plant
Hirakud (Indian Al. Co. Ltd.) Orissa		
Alwaye (Indian Al. Co. Ltd.)		
Both these plants (Hirakud and Alwaye) convert alumina into Aluminium metal. Alumina is produced at Muri from bauxite available at Bagaru Hills.		

Locational factors: Production of one tonne of Aluminum requires 18,573 KWh of electricity. Thus 40% of the production cost goes to Electricity alone. Thus, electricity & occurrence of Bauxite determine the location of an Aluminum Plant. Indian Aluminum Company was started in 1938 and Aluminum corporation of India in 1937 as a public limited company. Its plant started functioning in 1942 at Jaykaynagar in West Bengal. INDAL (Indian Aluminum Company Limited) set up its plant in Alappuzha (Kerala). During Second Plan, Hirakud in Orissa & Renukut in UP were installed by INDAL and HINDALCO; at Korba by BALCO in 1965 and also at Ratnagiri.

Copper Smelting

Indian Copper Corp. was set up in 1924. And First Plant was set up at Ghatsila in Singhbhum (Jharkhand). Hindustan Copper Limited came into being in 1967 & took over Indian Copper Corp in 1972. At present only two centers, Maubhandar (Ghatsila) & Khetri, (Jhunjhunu) are working.

HCL (Hindustan Copper Ltd.) set up in 1967 is only responsible organisation for the exploration and production of copper metal in the country. At present it controls the following plants:

Khetri Copper Complex: Khetri (Rajasthan): Ore from Khetri, Kolihan, Chandmari, Dariba and Khetri-Singhana area.

Indian Copper Complex: Ghatsila (Singhbhum district of Jharkhand): Ore from Musabani, Rakha, Dhobani- Rajdah, Tambapahar, Tumardih mines.

Malanjkhand Copper Project

Rakha Copper Project: Singhbhum

Dariba copper Project: Alwar (Rajasthan)

Chandmari Copper Project: Jhunjhunu (Rajasthan)

Agnigundala Copper Project (Andhra Pradesh).

Taloja Copper Project (Maharashtra).

Lead & Zinc Smelting

The first lead smelting plant was set up at Tundoo near Dhanbad in Jharkhand. Hindustan Zinc limited overtook it in 1965. HZL has setup a plant at Vizag also. The main ore region lies in Rajasthan at Zawar and Rajpur-Dariba. There are four Zinc smelters in the country at Alwaye (Kerala), Debari & Chanderia (in Rajasthan) and Vizag (Andhra Pradesh).

Lead smelting is controlled by Hindustan Zinc Ltd. (HZL) in India. The plants are:

1. **Tundoo (Dhanbad in Jharkhand):** Ores are collected from Zawar and Rajpur- Dariba
2. **Visakhapatnam (Andhra Pradesh):** Ores from Agnigundala.
3. **Chanderiya (Rajasthan):** Ores are locally available.

The main zinc smelting plants in India are:

1. **Alwaye (Kerala):** Based on imported supplies. The H₂SO₄ as a byproduct is supplied to the FACT.

2. **Debari (Rajasthan):** Depend upon imported zinc concentrates and ores from Rajpur-Dariba mines.
3. **Visakhapatnam (Andhra Pradesh):** Ores from Agnigundala area.
4. **Chanderiya (Rajasthan).**

Engineering Industry

Heavy Engineering Corporation, Ranchi produces manufacturing equipments. The Mining and Allied Machinery Cooperation is at Durgapur. The Bharat Heavy plates and vessels Ltd is at Visakhapatnam. The Bharat pumps and compressors Ltd. is at Allahabad. Hindustan Machine Tools with headquarters at Bangalore has factories at Pinjore (Haryana), Kalamassery (Kerala), Hyderabad and Sri Nagar (Zainakut). The Bharat Heavy Electrical Limited has manufacturing plants at Bhopal, Trichy, Hyderabad, Hardwar, Panipat, Bangalore and Jagdishpur.

Machine Tools

Machine tool industry is also a core industry upon which engineering industries flourish. The manufacturing started in 1932 with the advent of Kirloskar Brothers Limited. HMT (Hindustan Machine Tools) is the first large scale modern machine tool factory setup in Public Sector at Bangalore in 1953, with collaboration of Switzerland, The units are located at Bangalore, Hyderabad, Srinagar, Ajmer and in the state of Punjab. The Heavy Machine tools plant at Ranchi was started in 1966. Praga Tools limited at Secunderabad is mainly meant for defense equipments. Jadhavpur Unit (Calcutta) produces precision instrument.

Bangalore: First modern factory with Swiss assistance (1950); HMT unit I & II

Pinjore: HMT unit III (1963)

Kalamassery (Kerala): HMT unit IV (1964)

Hyderabad: HMT unit V (1965)

Ajmer: Grinding machine tools; HMT unit-VI Secunderabad

Ranchi: Heavy Engineering Equipment.

Rail-Locomotive

Chittaranjan: Steam locomotive for broad gauge and electrical locomotives.

Tatanagar: Metre gauge steam locomotives.

Varanasi: Diesel & Electrical locomotives.

Bhilai: Rail and sleeper cars.

Perambur & Bangalore: Rail coaches.

West Bengal: Produces about 60% of total wagons of India.

Ship-Building & Repairing

Vishakhapatnam: First in ship building in India.

Garden Rich (Kolkata)

Mazgaon Dock (Mumbai)

Kidderpore Dock (Kolkata)

Cochin Dock

Automobiles

The process started with General Motor Ltd. in 1928 at Mumbai, Ford Motors at Chennai in 1930, Premier Automobiles Limited at Kurla (Mumbai), Hindustan Motor Ltd. at Uttarpara (Calcutta), Motor cycles at Faridabad & Mysore.

Scooter - Lucknow, Catura, Akurdi (Pune)

Maruti - Gurgaon (Haryana), Bombay, Chennai, Jamshedpur, Kolkata.

Jabalpur - Military vehicles

Air Craft

HAL- Bangalore

Kanpur- Transport aircraft building

MIG aircraft engines are made at Koraput, air frames at Nasik and aircraft electronics at Hyderabad.

Heavy Electrical Equipment

Bhopal - Electric motors, turbines-generators and gears.

Ranipur (Hardwar)-Water turbine, generators and motors.

Hyderabad-Steam turbines and turboalternators

Tiruchchirappalli & Durgapur- High pressure Boiler of Thermal Power Plants.

Ramchandrapuram: Heavy Power Equipments.

Naini

Patiala.

Cement Industry

Tamil Nadu, Madhya Pradesh, Bihar, Gujarat Karnataka, Andhra Pradesh and Rajasthan etc

The first successful plant was setup in Porbandar in 1914.

Raw materials: Limestone, coal, gypsum- are weight losing. So this industry is preferred in the raw material source region.

State wise some important plants are as follows:-

M.P. (including Chhattisgarh): Jamul, Satna, Katni, Bandhor, Durg, Neemach.

Andhra Pradesh: Vijaywada, Karimnagar, Cementnagar, Krishna, Adilabad.

Rajasthan: Lakheri, Sawai-Madhopur, Chittorgarh, Udaipur.

Karnataka: Shahabad, Wadi, Kurkunta, Bagalkot, Bhadravati.

Tamil Nadu: Talaiyathu, Anangulam, Talukkapatti, Dalmiapuram, Madukkari, Poliyur.

Gujarat: Ranavar, Sikka, Sewree, Ahmadabad, Dwarka, Porbandar.

Jharkhand: Sindri, Khalari, Bhavnathpur, Japla, Dalmianagar, Chaibasa.

Orissa: Rajgangpur, Bargarh.

U.P.: Churk, Dalla.

Punjab: Bhupendre.

Maharashtra: Chandrapur.

West Bengal: Durgapur, Purulia, Bhatar, Asansol

Himachal Pradesh: Samloti, Rajban

At Present there are 133 large plants with an installed capacity of about 108 million tones. In addition there are 310 mini cement plants with an estimated capacity of 9 million tonnes. The total operative installed capacity is estimated to be around 109.56 million tonnes. Madhya Pradesh has the largest number of big plants (23 plants) followed by Andhra Pradesh (19 plants), Rajasthan (15 plants) and Gujarat (13 plants). During 1950-51, total cement production was only 2.7 million tonnes, which went upto 100.2 million tonnes in 1999-2000. Madhya Pradesh gives the maximum contribution in cement production of the country.

Pharmaceuticals & Drugs

Antibiotics are produced at Pimpri and Rishikesh. The Indian Drugs and Pharmaceuticals Ltd. has 5 plants at Hyderabad, Rishikesh, Madras, Gurgaon and Muzaffarpur. A number of other units are concentrated in Bombay, Baroda, Delhi, Calcutta and Kanpur.

Antibiotic plant-Rishikesh: Penicillin, Streptomycin

Synthetic Drug Plant-Hyderabad: Analgesics, Anti-T.B. drugs, Vitamins.

Surgical Instrument Plants: Chennai

Hindustan Antibiotics Ltd: Pimpri (Pune)

Hindustan Organic Chemical Ltd.: Rasayani (Maharashtra).

Hindustan Insecticides Ltd.: N. Delhi: It produces DDT.

Hindustan Insecticides Ltd Always: produces BHC.

Paper Industry

It is a forest based industry. Most of the paper production units are in West Bengal, Andhra Pradesh, Orissa, Maharashtra, Karnataka, Madhya Pradesh and Bihar. The National Newsprint and Paper Mills Ltd is located in Neapanagar (M.P.)

The first successful modern paper mill was established in 1870 at Ballygunj (West Bengal).

Newsprint Units: National News Print & paper Mill-Neapanagar, Hindustan Paper Corp Vellore, Mysore paper mill-Bhadravati.

Out of total output the share of printing & writing paper is of 57%, wrapping paper-22%, paper board-16%, Newsprint-6%, other-4%

W. Bengal: Titagarh, Raniganj, Naihati, Chandrahati, Calcutta, Baranagar, Bansberia.

Maharashtra: Ballarpur, Kalyan, Khopoli, Roha, Chinchwad, Kamptee, Pravaranagar, Sangli

Andhra Pradesh.: Rajahmundry, Sirpur, Bhadrachalam.

Orissa: Brajrajnagar, Rayagada, Chowdwar.

Karnataka: Dandeli, Bhadravati, Belagulla, Nanjangud, Ramangaram.

M.P.: Amlai, Bhopal, Indore, Sehore, Hoshangabad, Neapanagar.

Bihar: Dalmianagar, Rameshwarnagar, Samastipur

U.P.: Saharanpur, Basantnagar, Aghawanpur, Lucknow, Ujhani.

Haryana: Faridabad, Yamunanagar.

T.N.: Tambaram, Pallipalayam, Charanmahadevi, Udamalpet.

Gujarat: Barejadi, Khadki, Utran, Vapi, Marai, Gondal, Udvada, Barla

Kerala: Punalur, Kozhikode

Assam: Nowgong, Cachar.

Production wise W. Bengal holds the first position followed by Maharashtra, Andhra Pradesh, Orissa, Karnataka.

At present there are about 515 paper mills (including mills producing newsprint) in the country with an annual installed capacity of around 49 lakh tonnes. During 1999-2000 total production of paper and paper board was 34.59 lakh tonnes.

Fertilizers

The first public sector fertilizer factory was established at Sindri (Bihar) in 1951. The Fertilizer Corporation of India has four units at Sindri, Gorakhpur, (U.P.), Talcher (Orissa) and Ramagundam. The National Fertilizer Ltd. Has units at Nangal, Bhatinda and Panipat. Tamil Nadu, Uttar Pradesh, Gujarat, Kerala and Andhra Pradesh lead in the production of fertilizers.

IFFCO in co-operative sector has set up its units at Kalol, Kandla and Phulpur.

Tata fertilizer complex has set its units of Okhamandal in Gujarat.

Units under the Ministry of Mines are of Rourkela, Neyveli and Khetri.

Units under the National Fertilizer Ltd. are at Durgapur, Barauni, Namrup and Trombay-V

Gas based plants on HBJ Pipeline: Vijapur, Aonla, Hazira, Jagdispur, Godepan and Dabralla.

India produces 81% nitrogenous fertilizer and 19% phosphatic fertilizer, at present. Phosphatic fertilizer demands are almost fulfilled by import.

As per the nitrogenous fertilizer production is concerned, Gujarat stands first followed by U.P., Tamil Nadu, Punjab, Maharashtra, Bihar, Kerala and Haryana.

In the production of phosphatic fertilizer also, Gujarat stands first followed by Tamil Nadu, Maharashtra, Andhra Pradesh and Kerala.

Glass Industry

U.P.: Firozabad (for Bangles), Bahjoi, Hathras, Naini, Shikohabad.

Maharashtra: Mumbai, Telegaon, Pune, Sitarampur, Raniganj, Kolkata, Asansol, Durgapur.

Bihar: Bhadaninagar, Kandra.

Gujarat: Vallabh Vidyanagar.

Tamil Nadu: Tiruvottiyar

Karnataka: Belgaum

Ceramics

The first factory was established at Patharghatta (Jharkhand) in 1860.

Kolkata & Bangalore: Crockery, Insulators.

Gwalior, Delhi Jaipur, Bangalore, Mumbai: Earthware, Sanitary-ware, Drain-pipes.

Wankaner, Nazarbagh, Thangarh: Crockery, Tiles, Sanitary-ware, stone-ware.

Ranipet (Tamil Nadu): Acid jar.

Travancore (Kerala): Crockery

Rupnarayanpur, Jabalpur: Stone-ware, Pipes, Chemical stoneware.

Leather Industry

First unit was established in Kanpur in 1860 using vegetable tanning process. Being the holder of a large number of cattle, India has always been a big producer of leather goods.

West Bengal and Tamil Nadu are leading producer of cattle hides. Tamil Nadu is also a big producer of buffalo hides and sheep hides. U.P. is the leading producer of goat skins.

Tamil Centres: Kanpur, Chennai, Kolkata, Tonk, Mumbai. Tamil Nadu has the largest concentration of leather tanning units.

Footwear manufacturing centres: Kanpur, Agra, Chennai, Kolkata, Faridabad, Lucknow, Jaipur, Mumbai and Kolhapur.

State wise in the production of chrome tanned hides West Bengal is at the top followed by Tamil Nadu and U.P.

In the production of vegetable tanned hides U.P. ranks first followed by the West Bengal, Tamil Nadu and Maharashtra.

Rubber Industry

The first synthetic rubber factory was established at Bareilly in 1955. Automobile tyre and tubes account for 75% of consumption of natural rubber.

Synthetic rubber Unit : Bareilly, Baroda

Reclaimed Rubber Unit : Mumbai, Ahmedabad, Amritsar.

Match Industry

Box wood: Pipita, Dhup, Didu, Bakota-form Andaman & Nicobar; Mango, Samel, Salai—from Peninsular India.

T.N. is the top producer (28%) with main centres at Sivakasi, Sattur, Kovilpatti.

Kerala: Share 18% of production with main centres at Trichur, Parampavar,

Points to Remember

- 1) The process of coal formation consists of these stages of its formation; peat—Lignite — Bituminous—Anthracite.
- 2) Gems and Jewellery comes under the small scale and cottage industry.
- 3) The first modern paper mill of the country was set up in “Serampur” in West Bengal.
- 4) Synclines trap oil in the absence of water.

- 5) It is the method of “hydrogenation” through which crude oil may be obtained from the coal.
- 6) Kaolin or China clay is a fine clay formed by the alteration of granite by metamorphism.
- 7) The “cotton textile” industry in India provides the largest employment in India.
- 8) “Kimberlitic Pipe Rock” is the source rock for diamond.
- 9) Tungsten is a heavy metal with a melting point higher than any other metal.
- 10) “Sulinda in Orissa” is known for “chromite” deposits.
- 11) “Sillimanite” deposit is common in Meghalaya.
- 12) “Kyanite Deposits” are commonly found in Bihar.
- 13) “Jadugoda” mine in Jharkhand is known for uranium deposits.
- 14) India is world’s leading producer of “sheet mica”.
- 15) Bauxite deposits are mostly associated with “laterites”.
- 16) “Panna” of Madhya Pradesh is famous for “diamond”.
- 17) “Beryllium” is mostly used as moderator in nuclear power generation.
- 18) “Thorium” is processed from “monazite”.
- 19) Ramgiri Gold-field is in the state of “Andhra Pradesh”.
- 20) “Neyveli” in TamilNadu is famous for “lignite deposits”.

Mineral Resources

Minerals are the naturally occurring materials which when exploited economically are called ores. Their exploitation is possible when they occur in concentrated form and near the surface. India is endowed with a rich variety of minerals. The ancient archaic landmass contains both metallic and non-metallic minerals.

Distribution of Minerals

Though natural endowment in terms of mineral is quite high, its spatial distribution is highly uneven. The important areas are:

North-Eastern Peninsular Belt: This is an ancient shield area of peninsular block. It comprises of Chhotanagpur Plateau, Orissa Plateau and Chhattisgarh. It contains large quantity of coal, iron ore, manganese, mica, bauxite, copper, etc. It is known as mineral heart of India. It has 100% Kyanite, 93% iron ore, 84% coal, 70% chromite.

Central Belt: The region consists of MP, Chhattisgarh, Andhra Pradesh and Maharashtra. It is the second largest mineral belt of India. Large deposits of manganese, bauxite, coal, iron ore, graphite and limestone are found.

The Southern Belt: Mostly the Karnataka Plateau and Tamil Nadu highlands. It has iron ore, manganese, chromite but lacks in coal (except Neyveli coal), mica and copper.

The South- Western Belt: It includes south Karnataka and Goa. It has iron ore, granite and clay deposits.

The North-Western Belt: It extends along the Aravallis and adjacent Gujarat. It is important for non-ferrous mineral (copper, lead, zinc), uranium, mica, steatite, etc. It has mineral oil source in the Gujarat plains.

Iron-ore

India has the vast resources of iron-ore, about 20% of total world reserves.

Ore-Types: The ore-types are the following:

1. **Haematite:** It has the iron content up to 86%; mainly concentrated in the Dharwar and Cuddapah system of the peninsular India. It is also called as “Red Ores” which contributes about 85% of total national production
2. **Magnetite:** It has the iron content of 60%; mainly concentrated in the Dharwar and Cuddapah system of Indian peninsula. It is also called “Black Ores” and contributes about 8% of total production.
3. **Limonite:** It has 30-50% iron content and is the prominent constituent of laterite. It contributes about 7% of total production.

Iron-Ore Reserves	
Chikmanglur (Karnataka)	26%
Singhbhum (Jharkhand)	20%
Bastar (Chhattisgarh)	11%
Keonjhar (Orissa)	8%
Goa	5%

IRON-ORE-AREA	EXP. PORT
Goa	Marmagao
Bellary-Hospet	Mangalore
Kriburu-Bailadela	Visakhapatnam
Daitari- Nayagadh	Paradeep
Barbil	Haldia
Chikmanglur	Mangalore

Manganese Ore

It is primarily used for making iron and steel and it acts as basic raw material for manufacturing its alloy. It is also used in manufacturing of bleaching powder, insecticides, paints, batteries and China clay. In India it occurs in the form of sedimentary stratified metamorphic deposits of Dharwar System of Peninsular India.

Ore Types: Psilomelane, Braunite, Pyrolusite.

About 78% of total reserve is found in Nagpur and Bhandara districts of Maharashtra and Balaghat district of M.P. Singhbhum-Keonjhar-Bonai area holds the 11% of total reserve while the north Kanara shares 6%.

In terms of reserve M.P. (including Chhattisgarh) ranks first followed by Maharashtra, Orissa and Karnataka.

In terms of production Orissa ranks first followed by Karnataka, M.P. (including Chhattisgarh), Maharashtra and Andhra Pradesh.

Ferro-Manganese Plants: (1) Rayagada (2) Joda(both in Orissa) (3) Tumsar (4) Kamptee (both in Maharashtra) (5) Bhadravati (6) Dandeli (both in Karnataka) (7) Garividi (Andhra Pradesh).

Chromite

It is used for producing “Disodium” used for the manufacturing stainless steel.

Orissa ranks first in the production by contributing 90% of the national production, followed by Karnataka, Maharashtra, Jharkhand and Tamil Nadu.

About 96% production of Tamil Nadu is exported to Japan and the rest to Australia.

The production of chromite was of 1324 thousand tonnes in 1999-2000.

Nickel

Cuttack and Mayurbhanj districts of Orissa is famous nickel reserve and about 80% Orissa reserve is only concentrated in Kausa block.

India imports nickel to fulfill its domestic demand.

Bauxite

These deposits are mainly associated with laterite soils.

Upto 1988 India was an important importer of aluminium but in 1993 India has become a major exporter of alumina, mainly to Italy, Germany, U.K., Japan, etc.

In terms of reserves Orissa ranks first followed by Andhra Pradesh, M.P. (including Chhattisgarh), Bihar (including Jharkhand).

In terms of production Orissa also ranks first followed by Jharkhand, Maharashtra, Gujarat and M.P. (including Chhattisgarh).

Copper

Copper ores in India are found as sulphides (Chalcopyrite, Chalcocite, Bronite), oxides (Cuprite) and carbonates (Malachite and Azurite).

They generally occur in veins in Peninsular India in highly metamorphosed rocks.

In terms of reserve Rajasthan ranks first followed by Bihar (including Jharkhand), M.P.(including Chhattisgarh), Karnataka and Andhra Pradesh.

Gold

Generally found in quartz veins and sometimes associated with iron and copper sulphides.

Karnataka has been leading producer, since 1871 when the mining first started in Ooregum mines, Champion in Mysore. Other mines are Hutti, Topuldedi, Wondalli etc.

Ramagiri Gold field of Anantapuram district of Andhra Pradesh is another producer

The alluvial gold is found in the beds of Garranadi, South Koel, Sanjay, Subarnarekha river of Singhbhum district of Jharkhand.

Bharat Gold mines Ltd.: Founded in 1972 as a Public Sector which manages all the three operating mines of KGF area.

Hindustan Copper Ltd: Recover gold as a byproduct along with other metals from its Khetri deposits.

Silver

Generally in the form of Galena, Proustite mixed with copper, zinc or lead. Produced as by-product during the smelting of galena or produced from the lead ore of Kurnool, Cuddapah and Guntur of Andhra Pradesh; Singhbhum and Ranchi of Jharkhand; Vadodara of Gujarat. Quartzites of Mysore Gold field and cupriferous pyrites of Chitradurg also yield some amount of silver.

Diamond

The diamond is mostly available in Panna (Madhya Pradesh), Rammallakota in Andhra Pradesh and also in Krishna river basin. Presently diamonds are being excavated from only Panna mines.

Mica

In India the two important ores of mica-Muscovite and Biotite - are found.

In terms of production Bihar (including Jharkhand) ranks first followed by Andhra Pradesh and Rajasthan.

Kodarma in Jharkhand is the world's largest mica mine.

Ruby mica and Bengal mica, which is of high quality, is found in Bihar and Jharkhand.

Green Mica: (lightest of all types), also called as Electrical Mica; found in Andhra Pradesh.

In Rajasthan green or pink colour high quality mica are found.

A large quantity of mica is also exported. But now India is facing stiff competition with Brazil.

Limestone

Consumption of limestone in India: Cement Industry-67%, Iron & steel industry -16% chemical Industry - 4%

In terms of overall production of limestone M.P. (including Chhattisgarh) ranks first followed by Andhra Pradesh, Rajasthan, Gujarat and Karnataka.

Cement grade Lime-stone are mainly found in Andhra Pradesh, Karnataka, Gujarat and Rajasthan.

Flux grade limestone is mainly produced in MP (including Chhattisgarh), Meghalaya, Andhra Pradesh, Gujarat, Orissa, Jharkhand and Karnataka.

Asbestos

In India Amphibole and Crysolite varieties of asbestos are found.

Asbestos has the fibrous structure and has great economic importance as it has the capacity to be separated quickly into fine filaments of high tensile strength and its great resistance to fire.

In terms of production Rajasthan ranks first followed by Andhra Pradesh and Karnataka.

Fire Clay

It is used in making bricks for furnace.

These reserves are mostly available in Gondwana coal regions and basins. Bihar, Gujarat, Madhya Pradesh, Orissa, Tamil Nadu, Rajasthan, West Bengal and Andhra Pradesh are the states where fire clay is abundantly available.

Gypsum

Gypsum is a colourless or white mineral which contains calcium sulphate. Gypsum is used in the production of cement and plaster of Paris.

Most of its deposits are found in Rajasthan, Tamil Nadu, Jammu & Kashmir, Himachal Pradesh and Uttar Pradesh. Some deposits are also found in Gujarat.

Rare-Earths

In the south-west tip of India, on the Kerala and Tamil Nadu coast, an extremely rich minerals like Ilmenite and Monazite are found.

Ilmenite: From Quilon to Kanyakumari.

Ilmenite and Rutile are the by product in the by-products in the extraction of monazites.

Salt

About 75% of total salt produced in India is manufactured from saline sea water by the process of solar evaporation.

Sea-Salt: Gujarat (Mithapur, Jamnagar, Dharsana, Okha, Bulsar), Maharashtra (Bhandrup, Uran, Bhayandar), Tamil Nadu (Madras and Tuticorin).

Salt Lake: Sambhar, Didwana, Pachbhadra, Lankasara in Rajasthan.

Rock-Salt: Mined at present in Mandi district Drang and Guna in Himachal Pradesh.

In terms of production Gujarat ranks followed by Tamil Nadu and Rajasthan.

Kyanite

India has the largest reserves of Kyanite in the world. The distribution is as follows:

Jharkhand: A belt extending from Lapsa Buru to Kharasawan in Saraikela with the important mines at Lapsa-Buru, Ghagidih, Bachia- Bakro & Maoyaluka.

Maharashtra: Pahargaon & Pipalgaon in Sakohi Tehsil and Gorkha- Buranga and Asvalpain in Bhandara districts.

Off-Shore Mineral Wealth

“Polymetallic Nodules”, rich in some metals like copper, cobalt, nickel, manganese, are located on the deep sea floor of the Indian Ocean especially on the Central Indian Ocean basin.

Indian Institute of Oceanography- Goa is the prime organisation to explore these metals. India has accorded “Pioneer Investor” status in deep sea bed exploration by the U.N. in 1982.

The International Seabed Authority registered India’s claim for deep seabed mining in August 1987 and allotted a site of 1.5 lakh sq. cm. for further exploration in the central Indian Ocean.

Points to Remember

1. The occurrence of ore may be traced in Veins and Lodes, Beds and seams, weathering products and alluvial deposits.
2. A number of organisations such as the “Geological Survey of India”, Mineral Exploration Corporation Limited”, and Indian Bureau of Mines” are engaged in exploration and development of mineral resource.
3. The “Damodar Valley” in India has the largest concentration of mineral resources.
4. “Lignite” is chiefly found at Neyveli in Tamil Nadu.
5. Bihar has the largest coal reserve in the country; it is 37%, of the total coal reserve of India, West Bengal has 18% and Madhya Pradesh has 16 percent.
6. More than 33 percent of India’s iron ore production comes from Orissa especially from Keonjhar, Mayurbhanj and Bonai.
7. Jharkhand ranks second in iron-ore production and accounts for 27% of the total production of India.
8. India is the fifth largest producer of manganese in the world and in India; Madhya Pradesh occupies the top position with 97% of the total production of India.
9. The diamond mines in India are located Panna and Satna in Madhya Pradesh and Mirzapur district of U.P.
10. India is the largest producer of mica in the world. It accounts for about 67% of the global trade.

Natural Vegetation Flora and Fauna

Natural vegetation may be defined as that part of plant communities which has been remaining undisturbed over a long period of time. Here the individual species adopt themselves to certain soil and climatic conditions and proliferate through natural process.

On the basis of appearance of the plant community with respect to form and other characteristics, the vegetation of India is commonly identified as forest, grasslands and shrubs. The climate, specially the sunshine and precipitation, determines the type of plant species that can survive in a particular region.

On the basis of climatic condition, the vegetation has been classified as: - *Tropical Evergreen forests, Monsoon forests, Temperate Forests, Grasslands, Tundra, Savanna, Prairie, Alpine* and so on.

Basic terms:

Flora: It refers to the plants of a particular region or period, listed by species and considered as a group.

Vegetation: It refers to the assemblage of plant species living in association with each other in a given environment often termed ecological frame.

Forests: Forest is a large tract covered by trees and shrubs. It consists of forests, grassland and scrub.

Forest Area

Forests constitute about 23% of India's total land surface and occupy 746 lakh hectares of land. The Chhattisgarh and MP covers 7217 hectare, Arunachal Pradesh 5110 hectares, Orissa – 2857 hec, Andhra Pradesh- 2724 hec, Maharashtra- 2724 hec and Uttaranchal - 1887 hectares.

Major Vegetation Regions

1. **Tropical Evergreen or Rain Forests:** These forests occur in areas where the rainfall exceeds forests occur in areas where the rainfall exceeds between 20°C to 27°C and average annual humidity exceeds 77 per cent. The trees are evergreen and dense and forests have a three storied appearance. These forests are found in Western parts of Western Ghats, eastern part of subtropical Himalayas (Terai), north east India comprising Lushai, Cachar, Khasi, Jaintia and Garo hills and most of Andaman and Nicobar Islands.

These forests may be sub divided into the following sub-types:

- i. **Tropical Wet Evergreen Forests:** They cover 4.5 m. ha area and are found along the western side of the Western Ghats, in a strip running south-west from Arunachal Pradesh, upper Assam, Meghalaya, Nagaland, Manipur, Tripura and Andaman and Nicobar Islands. Here the rainfall exceeds 300 cm. The forests are lofty, dense, evergreen and multistoried.

The main species of trees found are Poon, toon, chaplas, rosewood, ebony, Sissoo, ironwood, Gurjan, pila champa etc. The undergrowth consists of canes, bamboo, ferns, climbers etc. Due to the dense undergrowth and lack of transport these forests have not been exploited.

- ii. **Tropical Semi-evergreen Forests:** Where the rainfall is somewhat less than 200 cm, the mean annual temperature between 24°C to 27°C and humidity percentage is 80, the evergreen forests degenerate into semi-evergreen forests. These cover 1.9 m. ha area. These forests are found on the western coast, in upper Assam, lower slopes of eastern Himalayas, Orissa and in Andaman and Nicobar islands. The forests have evergreen trees mixed with deciduous types. The important species include Aini, Semul, Kadam, irul etc.
- iii. **Tropical Moist Deciduous Forests:** Such forests occur in areas of low annual rainfall of 100 cm to 150 cm. The main annual temperature is between 26°C to 27°C, and humidity percent is 60 to 80. These forests are found in a belt running north-south on eastern slopes of western ghat, central plateau including Chotanagpur, Upper Mahanadi Valley and hills of Madhya Pradesh, Himalayan foothills, eastern ghats in Tamil Nadu and Andaman and Nicobar islands.

These forest trees shed their leaves and are the most important forests source of commercial timber. The species of trees include Sal, teak, Arjun, jarul, laurel, Andaman paduk, ebony, mulberry, Kusum, kanju, ber, gular, palas, haldu, siris, mahua, Semul, har, sandalwood, jamun etc. Most of these forests have been cleared from level land for cultivation.

- iv. **Littoral and Swamp Forests:** These forests cover 6 lakh ha and occur in and around tidal creeks and river deltas. They are found in thickets on western coast at a few places but on the eastern coast they form a continuous belt on the fringe of deltas of Ganga, Mahanadi, Godavari, Krishna and Cauvery. They are densest in Sunder-bans, where Sundri trees predominate.
2. **Dry Tropical Forests:** These forests occur in areas having annual rainfall between 75 cm to 125 cm, mean annual temperature of around 23°C to 27°C and humidity between 51 to 58 per cent. They are divided into the following sub-types.
 - i. **Tropical Dry Deciduous:** These forests are found on a very large area in an irregular wide strip running north south from the foothills of Himalayas to Kanyakumari except in Rajasthan, Western Ghats and West Bengal. The important trees include teak, tendu, sal, bijasal, rosewood, palas, bel, lendi, axlewood, anjair, harra, khair etc.
 - ii. **Tropical Thorn Forests:** They are restricted to areas where rainfall is very low i.e. between 50 cm to 75 cm, the mean annual temperature is between 25°C to 27°C and humidity is less than 47 per cent. They are found in Kutch, neighbouring parts of Saurashtra, a large strip in south western Punjab, western Haryana, western and northern Rajasthan, Upper Ganga plains, Deccan plateau and lower peninsular India. Here thorny trees especially acacias predominate.
 - iii. **Tropical Dry Evergreen Forests:** These forests occur in areas where the mean annual rainfall is about 100 cm, mean annual temperature is about 28°C and mean annual humidity is 74 per cent. These forests are found in the east coast of the peninsula. The important species of trees include khirni, jamun, kokko, ritha, neem, palm, etc.
 3. **Riparian Forests:** Where the rainfall is less than 50 cm, short trees and grass predominate. These forests are found along banks of rivers and wet lands. Deciduous vegetation like neem, Shisham, pipal, mango, jamun, khair are usually found. Kans and munj grass are found in abundance.

4. **Subtropical Broad Leaved Hill Forests:** The forests are found between 915 to 1830 m height above sea level where the mean annual rainfall is between 75 cm to 125 cm, mean annual temperature is between 18°C to 21°C and humidity percent is 80. These forests are found in high lands of Bastar, Panchmarhi, Mahabaleshwar, Nilgiris, Palni and Khasi hills and lower slopes of Himalaya in West Bengal and Assam. Such forests are called 'Shola' in South India.
5. **Montane Wet Temperate Forests:** These forest occur at a height of 1800 to 3000 m above sea level in areas where annual rainfall is between 150 to 300 cm, annual temperature is between 11°C to 14°C and humidity per cent is 83. These forests are found in hills of Tamilnadu, Kerala, Eastern Himalayas, higher hills of West Bengal, Assam and Arunachal Pradesh. The main trees found are deodar, Indian Chestnut, magnolia, birch, plum, blue pine, oak, hemlock etc.
6. **Montane Moist Temperate Forests:** They occur in temperate eastern and western Himalayas between the pine and alpine forests in Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Darjeeling and Sikkim between 1600 to 3500 meters. The forests are predominantly coniferous forests and include trees like pine, deodar, spruce, silver fir, oak, beach, birch, polar, elm, chestnut, maple, rhododendrons etc.
7. **Alpine Forests:** They occur in the Alpine areas of the Himalayas beyond the limit of tree growth i.e. between 2900 to 3500 m and consist of dwarf shrubs of juniper, fir, honey suckle, birch, rhododendrons etc. At still higher altitudes, shrubs of low herbs are the only vegetation found.
8. **Grasslands:** These grasslands are divided into three types (i) Hilly or upland grassland. They are found in Himalayas above 100 m and in Deccan hills (ii) low land grasslands - They occur in plains of Punjab, Haryana, Uttar Pradesh, Bihar and north western parts of Assam (iii) Riverine grasslands. They are found in riverine tracks of northern India especially in the bhabhar tracks.

Points to Remember

1. The total forest cover in India is "6, 37,397" sq. hectare which constitutes about "19.39" percent of the total geographic area and the per capital forest in India is 0.2 hectares.
2. Area wise, at present, Arunachal Pradesh has the highest coverage of forest, earlier it was M.P.
3. Among the Union territory, Andaman and Nicobar has the largest area under forest.
4. As far as the "mangrove" forest is concerned, "West Bengal" holds the first position followed by Gujarat and Andaman Nicobar.
5. The tropical "Moist Deciduous Forest requires annual rainfall of 200 cm mean annual temperature of 26^o - 27^oC.
6. The Wood - cellulose is the basis of the synthetic textiles and is popularly known as "rayon". The USA, Japan and European countries are the major rayon producers of the world.
7. In India, timber is largely derived from the forests of Madhya Pradesh, Orissa, Karnataka, U.P. Assam, Jammu and Kashmir.

8. An important medicinal plant is “Cinchona”. The drug quinine is extracted from the bark and wood of this tree.
9. The coca shrub’s leaves are the sources of the drug “cocaine”.
10. Morphine and heroine are also produce or collected legally from forest plant or Opium poppies.
11. In India, Andhra Pradesh, Tamil Nadu, Rajasthan, Madhya Pradesh, Bihar and Assam account for about 70 percent of the bamboo production.
12. The “Riverine grasses” are found in northern parts of India which forms the “Bhabar Pastures”.
13. The densest trees are found in great “Sunderbans delta” where the Sundri trees in abundance are found.
14. The Tropical dry evergreen forest requires annual rainfall of 10 cm with 28°C of average temperature and of 74% of humidity.

FLORA AND FAUNA

Owing to a wide range of climatic condition, India can boast of a rich and varied vegetation. In the remote hilly tracts of the Himalayas and Deccan mountains, a large number of endemic flora i.e. Plants that have grown there for millions of years and are not found to grow naturally elsewhere in the world, is found here.

In recent years, many of these endemic plants are facing extinction because of ecological disturbance. There are eight floristic regions of India:

- I. The Western Himalayas
- II. The Eastern Himalayas
- III. Assam
- IV. The Indus plain
- V. The Ganga plain
- VI. Deccan
- VII. Malabar
- VIII. Andamans.

India has the forest cover of 22 per cent while the actual forest cover is only about 11 per cent of

the total country area. Coniferous forest cover only 6 per cent and the broadleaf deciduous forests comprise about 94 per cent of the total forest cover.

Forest as % of total area of the state:

Andaman & Nicobar Islands (73%) > Arunachal Pradesh (62%) > Manipur (61%) > Mizoram (57%) > Meghalaya (55.4%) > Tripura (49.5%) > Nagaland (49%) > Sikkim (39.5%) > M.P. including Chhattisgarh (35%) > Goa (20%) > Andhra Pradesh (20%) > Himachal Pradesh (16%) > Gujarat (15%) > Karnataka (14%) > Tamil Nadu (13%) > Uttar Pradesh including Uttarakhand (12%) > Maharashtra (11.8%) > W. Bengal (8.8%) > Jammu and Kashmir (65%) > Rajasthan (4.1%).

India has a great variety of fauna, with about 500 species of mammals and 2,100 species of birds and reptiles. Some rare and extinctive species are found in certain pockets in India important among them are the Asiatic lion, now confined to the Gir forest; the one horned rhinoceros, a vanishing species in Assam and the great Indian bustards, now rarely seen in Rajasthan.

Some plant and animal species are protected under various schemes and a number of wildlife sanctuaries have been planned for the conservation of animal species. The National wildlife action plan was adopted in 1983. It provides the framework of strategy as well as program for wild life conservation. The wildlife & reserves in India can be classified into ‘National Parks’ and ‘Wildlife Sanctuaries. The National parks protect the entire ecosystem, where as wildlife sanctuaries have the special purpose of preserving animals and birds. There are, at present, 68 national parks including marine parks, high altitude parks and parks in protected areas of Andaman and Nicobar and 367 wild life sanctuaries.

The Red Panda project was started in 1996 in the Padmja Naidu Himalayan Zoological Park. The Manipur Bow Antler deer project was started in 1977 in Kaibul Lamjoa in Manipur near the Loktak Lake. The Gir Lion sanctuary project was launched by the Gujarat government in the Gir wildlife sanctuary in 1972. The Himalayan musk deer project was started in the Kedarnath sanctuary in Uttarakhand. The crocodile project was started in 1975 in Orissa. Later Uttar Pradesh, Rajasthan, West Bengal, Tamil Nadu, Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Bihar, Andaman and Nicobar Islands and Nagaland were included in this project. Project Hangul was started in 1970 in the Dachigam national park in Kashmir.

The national bird of India, the peacock, is found along with many species of birds throughout India. The only ape found in India is the Hoolock Gabon in Assam.

National Parks and Wild Life Sanctuaries

National Park/Sanctuary	Place	State
Kaziranga National Park	Jorhat	Assam
Manas Wildlife Sanctuary	Barpet	Assam
Namdafa Wildlife Sanctuary	Tirap	Arunachal Pradesh
Chandra Prabha Sanctuary	Varanasi	Uttar Pradesh

Corbett National Park	Nainital	Uttar Pradesh
Dudhwa National Park	Lakhimpur Kheri	Uttar Pradesh
Malan Sanctuary	Paudi Garhwal	Uttar Pradesh
Govind Sanctuary	Uttar Kashi	Uttar Pradesh
Simlipal Sanctuary	Mayurbhanj	Orissa
Kaaval Sanctuary	Adilabad	Andhra Pradesh
Nalpati bird Sanctuary	Nellore	Andhra Pradesh
Kolleru	Elikeneri Elleru	Andhra Pradesh
Mudumalai Sanctuary	Nilgiri	Tamil Nadu
Vedanthangal bird Sanctuary	Chinglepet	Tamil Nadu
Bandipur National Park	Bandipur	Karnataka
Dandeli Sanctuary	Dharwar	Karnataka
Sharavati Valley Sanctuary	Shimoga	Karnataka
Rangathitoo Bird Sanctuary	Mysore	Karnataka
Banarthatta National Park	Bangalore	Karnataka
Bhadra Sanctuary	Chikmanglur	Karnataka
Mukambil Sanctuary	Kanara	Karnataka
Nagarhole National Park	Durg	Karnataka
Someshwar Sanctuary	Kanara	Karnataka
Tungabhadra Sanctuary	Bellary	Karnataka
Benurd Sanctuary	Kozhikode	Kerala
Irambikulam Rajmallai Sanctuary	Idukki	Kerala
Parambikulam Sanctuary	Palghat	Kerala
Periyar Sanctuary	Idukki	Kerala
Kanchanjunga National Park	Gangtok	Sikkim
Dampha Sanctuary	Aizawal	Mizoram

Balaram National Park	Banaskantha	Gujarat
Gir National Park	Junagarh	Gujarat
Dachigam Sanctuary	Sri Nagar	Gujarat
Jaldapara Sanctuary	Jalpaiguri	West Bengal
Sunderban Tiger Reserve	24 Pargana	West Bengal
Palamau Sanctuary	Daltonganj (Betla)	Bihar
Bhimbandh Sanctuary	Monghyr	Bihar
Gautam Buddha Sanctuary	Gaya	Bihar
Hazaribagh Sanctuary	Hazaribagh	Bihar
Dalma Sanctuary	Singhbhum	Bihar
Panchmarhi Sanctuary	Hoshangabad	Madhya Pradesh
Madhav Nation Park	Sheopuri	Madhya Pradesh
Bori Sanctuary	Hoshangabad	Madhya Pradesh
Kanha Kisli National Park	Balaghat	Madhya Pradesh
Bandhavgarh National Park	Shahdol	Madhya Pradesh
Indravati National Park	Bastar	Madhya Pradesh
Fossil National Park	Mandla	Madhya Pradesh
Panna National Park	Panna	Madhya Pradesh
Sanjay National Park	Sidhi (Sarguja)	Madhya Pradesh
Satpura National Park	Hoshangabad	Madhya Pradesh
Ratapani Sanctuary	Raisen	Madhya Pradesh
Borivalli Sanctuary	Mumbai	Maharashtra
Tadowa Sanctuary	Chandrapura	Maharashtra
Pench Sanctuary	Nagpur	Maharashtra
Navgaon National Park	Bhandara	Maharashtra

Ranthambhore National Park	Sawai Madhopur	Rajasthan
Sariska Sanctuary	Alwar	Rajasthan
Keoladeo Ghana Bird Sanctuary	Bharatpur	Rajasthan
Sikridevi Sanctuary	Mandi	Himachal Pradesh
Rohella Sanctuary	Kullu	Himachal Pradesh
Ross Island National Park	Ross Island	Andaman and Nicobar
Marine National Park	Andaman	Andaman and Nicobar

Biosphere Reserves in India

Reserve	State
Nilgiris	Tamil Nadu, Kerala, Karnataka,
Nam Dapha	Arunachal Pradesh
Nandadevi	Uttarakhand
Northern Islands of Andaman	Andaman and Nicobar
Gulf of Mannar	Tamil Nadu
Kaziranga	Assam
Sunderbans	West Bengal
Thar Desert	Rajasthan
Manas	Assam
Kanha	Madhya Pradesh
Nokrek (Tura Range)	Meghalaya
Simlipal	Orissa

Points to Remember

1. The Wild Life Protection Act - 1972 adopted by all states except Jammu and Kashmir and India is signatory to the convention on International Trade in endangered Species of Wild Flora and Fauna under which the commercial exploitation of the species is prohibited.
2. India possess about 8% of the world's known living organism while it has only 2 percent of the world's land mass.
3. At present about 15,000 plant species and 75,000 animal species are facing extinction.
4. In the state of Maharashtra, Madhya Pradesh and Andhra Pradesh, the elephant has almost all disappeared.
5. The North-east India has over 600 different orchid species which are now facing extinction.
6. The idea of biosphere reserves was initiated by UNESCO in 1973-74 and the first reserve in the Nilgiri was established in 1986.
7. The "Man and Biosphere" (MAB) programme was launched by the government of India for the conservation of the biological diversity.

8. Asiatic lion, one of the rarest and most important wild animals in India is found in only two parts of the country: the famous Gir National Park in Gujarat and the Chandraprabha wildlife sanctuary of Uttar Pradesh.
9. The one horned rhinoceros is also vanishing but now it is found in Assam's Kaziranga National Park and Manas wildlife sanctuary.
10. The Dachigam National Park of Kashmir protects the hangul or Kashmir Stag.
11. The largest areas reserved for sanctuaries are in Madhya Pradesh, Andhra Pradesh, Gujarat and Karnataka, but the proportion of sanctuary area to forest area is highest in Gujarat.
12. The word "National Park" refers to relatively large area of one or more ecosystem that has not materially altered by human exploitation and occupation. The place is especially meant for plants, animals and habitats for special scientific education.
13. The concept of "Wildlife-Sanctuary" is more or less similar to the national park but it is chiefly meant to protect wildlife and conserve species. Its boundary is not fixed by the legislation.
14. The concept of "Biosphere Reserves" refers to the multipurpose protected area to preserve the genetic diversity of the ecosystem. Its main objectives are; to conserve integrity and diversity of plants, animals and micro-organism, to provide facilities for education, awareness and training and to promote research on ecological conservation.
15. The "Operation Tiger" was launched by WWF in 1973 to protect the tiger from further extinction.
16. Of the total 27 tiger reserves in India, Nagarjunasagar Tiger reserve of Andhra Pradesh is the largest with an area of 3,568 sq km.

The National wildlife Action plan was adopted in 1983.

POPULATION

Human geography embraces the study of human race, the growth of human numbers, the movements and density of population, etc. Thus human geography is a science which studies the relationship between man and environment.

Factors Influencing Population Distribution

1. **Accessibility:** Man was unable to reach inaccessible areas of forest, islands, mountains for a long time, so such areas have low density as in the Amazon basin, S. American Plateaus, etc.s
2. **Relief:** Steep gradients, high mountains, rugged-terrain restrict settlement because of hindrances in movement. Similarly rivers may exert either a positive or negative effects. Most attract settlement but some are liable to flooding, change of course and so hinder settlements.
3. **Altitude and Latitude:** There are very few settlements above 5500 m in Andes and Himalayas. 'La Paz' (Bolivian Capital) is at the height of 3640 m. Low latitude high plateau areas provide positive advantage.
4. **Climate:** Extreme heat, cold, humidity and aridity deter settlement. Success of crops also depends on climate. But no specific climate is optimum for settlement as obvious from the fact that two of the world primary concentration of population lie in middle latitude and the third is located in the tropics. For example Java Island and Amazon Basin have the same climate but population density of Java is over 500 whereas Amazon basin has less than 1.
5. **Soil:** Deltaic and alluvial soils attract settlement while laterites and podzols repel. All ancient civilizations evolved in alluvial soil regions. Higher density of Jawa as compared to Sumatra is also due to soil fertility.
6. **Natural Vegetation:** It may also exert positive as well as negative effects on settlement.
7. **Mineral and Energy Resources:** Population map of W. Europe is more or less identical to distribution of coalfields and other industries. S. African Rand, Appalachian Coalfield, Donetz Basin, W-Australia also show its effects.
8. **Economic Factor:** Density of population is directly proportional to technological and economic advancement. Migration of Indian labourers to Mauritius, Trinidad and Fiji under colonial rule shows this pattern.
9. **Political Factors:** Unlike communist countries in the western world various inducements may be offered to encourage migration to new towns. Mass migration of Asian from Uganda in 1972 is another example.
10. **Historical Factor:** Relatively recent settlement of Australia is the basic reason for its low density of 2. While high density of India is liable to be explained in terms of its long history of civilization and occupancy.

I. High Density zone

1. **East Asia** including China, Japan, Korea, Philippines, etc.
2. **S.E. Asia** including Burma, Malaysia, Indonesia, Thailand, Cambodia, Vietnam.
3. **S.Asia** including India, Srilanka, Bangladesh, Bhutan, Nepal, Pakistan etc.
4. **N.W. Europe:** including European former USSR.
5. **N.E. Coastal N. America**
 - The first three concentration zones belong to Monsoonal regions having about 57% of the world population. China and India alone constitute 38% of world population. East Asia has 25% and S.Asia has 23% of World Population.
 - Monsoonal regions are characterized by vast fertile land, favourable climate for agriculture, perennial rivers, paddy farming and historical inertia of human settlement and all these favour greater concentration.
 - Western Europe and NE N. America have very high population density due to tremendous development of secondary and tertiary industries.
 - Although having almost infertile lands small countries like Netherlands, Belgium, Luxemburg have very high density because of high industrial development and other non-primary activities like fisheries and forestry.

II. Medium Density Zone

- The density of this zone is between 50 and 70. Their zone contains 5% of the world population.
- It includes most geographical regions of Savanna land, mid-latitude regions and the plateau regions of Equatorial and Monsoonal condition.
- Most of the countries in this region have entered into the 2nd phase of demographic transition, i.e. witnessing population explosion.
- It includes Mediterranean coastal parts of Morocco, Algeria, Tunisia in N. Africa, Mediterranean coast of Asia, Plains of Tigris and Euphrates, Eastern Brazil, S.E Australia, Californian Region, Coastal Argentina, Venezuela and Chile, South Africa etc.

III. Low Density Zone

- It includes regions having population density below 50. It includes about 55% geographical area of the world.
- They are the regions of invariable geographical condition or the regions of extremely low density, e.g.
 1. Dense forest like Amazon and Zaire basin.
 2. Dense forest like Taiga
 3. Cold deserts like Central Asiatic, Patagonia.
 4. Hot deserts like Sahara (density of about 1), Australian desert.
 5. High altitude plateau like Tibet (density of below 3), Bolivia.
 6. Mountains with altitude above 5000 ft.
 7. High latitude regions like Alaska, N. Canada, Greenland, Siberia (density of about 1).

Demographic Transition Theory

Formulated by Frank Notestein in 1953, the theory of Demographic Transition makes an attempt to document the experience of developing countries as affected by the presentday economic growth. 'Demographic Transition' is described as the passage through which countries move from high birth and death rates to low ones. This has been the experience of countries going through a process of modernizing economic and social development.

Stages of Demographic Transition

1. The **first stage** is characterized by high birth and death rates. High death rates in such a society could be due to chronic malnutrition, famines and epidemics, inadequate medicinal and health services and poor living condition. High birth rates are influenced by the socio-cultural system (i.e. illiteracy, early marriage, traditional values, religious beliefs, demand for family labour, etc.).
2. In **stage two**, that of a developing country, the death rates drop rapidly due to improvements in food supply and sanitation, which increase life spans and reduce disease. These changes usually come about due to improvements in farming techniques, access to technology, basic healthcare, and education. Without a corresponding fall in birth rates this produces an imbalance, and the countries in this stage experience a large increase in population.
3. In **stage three**, birth rates fall due to access to contraception, increases in wages, urbanization, a reduction in subsistence agriculture, an increase in the status and education of women, a reduction in the value of children's work, an increase in parental investment in the education of children and other social changes. Population growth begins to level off.
4. During **stage four** there are both low birth rates and low death rates. Birth rates may drop to well below replacement level as has happened in countries like Germany, Italy and Japan, leading to a shrinking population, a threat to many industries that rely on population growth. As the large group born during stage two ages, it creates an economic burden on the shrinking working population. Death rates may remain consistently low or increase slightly due to increases in lifestyle diseases due to low exercise levels and high obesity and an aging population in developed countries.

Growth Rate of Developing Countries

Countries of Explosion: Most of the Islamic countries, Latin America, S. Africa, S.E-Asian countries. It has very high birth rate over 30% and low death rate of 15%, so natural increase is very high.

Countries of Potential Explosion: Central African & some S.E Asian countries like Cambodia, Laos, Vietnam. At present both high birth rate and high death rate over 40%. But in the near future death rate will go down hence the population explosion.

Countries of Managed Population: They have successfully managed the growth rate like China (1.2%), Jamaica (1.4%), S. Africa (0.8%) and El-Salvador (1.2%).

World Population	Growth
1 AD	0.25 billion
1650 AD	0.50 billion
1820 AD	1 billion
1930 AD	2 billion
1960 AD	3 billion
1975 AD	4 billion
1987 AD	5 billion
2000 AD	6 billion
2025 AD	billion (estimated)
2050 AD	10 billion (estimated)

Races of the World

- a. **Caucasoid:** The Caucasoids are numerically one of the largest groups and it includes not only white Europeans and people of European origin living elsewhere, but also Arabs and most of the people of the Indian sub-continent. It accounts for 33% of the world population. Caucasoids are also divided into Nordic (Northern Europe), Alpine (central Europe) and Mediterranean people (Arabs, Jews and People of Indian sub-continent).
- b. **Mongoloids:** Mongoloids are represented by the Chinese. Amerinds (native American Indians) are perhaps an early offshoot while the Polynesians are a sub-group of the Mongoloids with a great deal of racial intermixture. They constitute 43% of the world population.
- c. **Negroids:** The Negroids are represented by the African people.
- d. **Australoids:** Mostly tribal people are represented by these races.
- e. **Hottentots and Bushmen:** Africa tribe of West coast and Atacama desert.

Population Terms

Birth Rate: Number of the live births per year per 1,000 of the population.

Death Rate: Number of deaths per year per 1,000 of the population.

Infant Mortality: Number of deaths of children below 1 year of age per 1,000 of the population.

Life Expectancy: The average age at which people die. It does not mean the age at which most people die.

Migration: Migration is broadly defined as permanent or semi-permanent shifting of residence.

Natural Increase: Excess of births over deaths per 1,000 of population. This does not include increase in population due to immigration.

Net Reproduction Ratio: Rate at which women are replaced by daughters who will have children.

Optimum Population: A country is said to have optimum population when the number of people is in balance with the available resources.

Regional Variation in Growth		
World growth rate	:	1.7%
Africa	:	3.0%
Latin America	:	2.2%
Asia	:	1.7%
Former USSR	:	1.0%
N. America	:	0.9%
Europe	:	0.3%
Oceania	:	1.5%
Developing Countries	:	2.0%
Developed countries	:	0.6%

Tribes of World	
Aborigines	Earliest people of Australia
Bantus	Central and Southern Africa
Bedouins	Nomadic tribe in Africa and South West Asia
Berbers	Algeria, Morocco, Tunisia.
Bindibu	Western Australia
Bushman	South west-Africa, Kalahari Desert

Eskimo	Tundra region in Canada and Greenland
Finns	Tundra of Europe
Gaicho	Uruguay, Argentina
Hamits	North-West Africa
Kirghiz	Steppes of Asia
Kikuyu	Kenya
Lapps	Tundra of Europe
Maori	New Zealand
Masai	East Africa
Mbuti	North Equatorial region
Papuans	New Guinea
Poonan	Borneo
Pygmies	Congo (Zaire) Basin
Red Indians	North America
Samoyeds	Asiatic Tundra
Tartars	Siberia
Tawa	Near Equator
Veddas	Sri Lanka
Yakut	Tundra region
Yukaghirs	East Siberia

Points to remember

1. 'Life expectancy' refers to the average age at which people die; it is 62 years in India, 80 years in Japan and 77 years in Britain.
2. "Jarawas" are inhabitants of Little Andaman.

3. "Gauchos" are nomads of the Pampas or Uruguay and Argentina.
4. "Eskimos" are the group of people known as Mongoloid.
5. The Nilotic and Hamitic people of eastern Africa belong to the Negroid group.
6. North-West Europe has the highest density of population.
7. "Kikuyu" are the group of people of the Kenya region.
8. "Masai" is the aborigines of tropical grassland of east Africa.
9. "Bushmen" is the aborigines of Kalahari Desert of Africa especially living in Namibia, Botswana and Angola.
10. "Bedouins" are the pastoral nomadic tribe in Arabia who depends upon camel breeding and roam in search of fodder.
11. The "working age group" or "population" is constituted by the people of "15 to 59" years.
12. The population below the 13 years of age is designated as young and over 60 years as "old".
13. Five largest linguistic group in descending orders in India: Hindi, Bengali, Telugu, Marathi and Tamil which constitute 40.42%, 8.30%, 7.87%, 7.45% and 6.32% respectively.
14. In terms of the number of speakers "Hindi" occupies "fourth" place in the world.
15. The highest density of urban population in a descending order; Singapore (100%), Belgium (96.8%), U.K. (88.2%) and Netherlands (70.0%).

SOILS OF INDIA

Soils in India display wide diversity because of the variations in the climate and relief. The soilforming components which include parent material, relief, climate and natural vegetation vary spatially. The soil can be classified under various criteria, most acceptable being based on horizon development and its relationship with climatic condition.

The factors that affect the soil formation are:

- 1. Parent Material:** The parent material, of which the soils are formed, is derived from the weathering of the rocks exposed on surface. For example the soil derived from lava and rocks is generally black in colour.
- 2. Relief Features:** They influence the process of soil formation through various ways. The variation in relief features like slope, underground water etc. affect the colour, composition and properties of soil.
- 3. Climate:** Climate is the most important single factor in soil formation. It affects the conditions of soil formation through the amount and seasonal distribution of temperature and rainfall. It also affects soil formation indirectly by affecting other genetic factors like parent material, relief features, natural vegetation etc.
- 4. Natural Vegetation:** The decayed leaf material adds to the fertility of soil by providing to it the much needed content of humus. That is why the densely forested areas contain some of the best soils.

Soil Types

The Indian Council of Agricultural Research (ICAR) has divided the Soils of India into 8 major groups.

- 1. Alluvial Soils including the coastal and deltaic alluvium:** Agriculturally the most important soil. It covers 24% of the country's total area. Mainly found in Central plains extending from Punjab to Assam, Eastern and Western Coastal plains and deltaic region. Alluvial soil is transported or inter-zonal soil. It is divided into Khadar (newer) and Bhabar (older). This soil is, however, deficient in nitrogen and humus content; unsuitable for water retentive plantation e.g. cotton. It is suitable for the cultivation of rice, wheat, sugar cane and vegetables.

Khadar: Finer and newer alluvium. Its texture varies from clayey to sandy loam. It is light in colour and is formed in the flood-plains of rivers and is generally acidic, deficient in lime, phosphorus and humus.

Kankar: They are found only few feet below the surface of Bhangar which is a bed of lime nodules known as kankar. Kankars are collected near Dadri in Haryana for making cement.

Bhangar: They are older alluvium or coarse gravel, high level soils above 30 m above flood level where flood water cannot reach. Its texture is more clayey and the colour is darker.

Alluvial texture varies from sand and loam to silts and heavy clays that are ill drained and sometimes injurious accumulations of salt and produces a sterile surface called “**Usar**”.

In the sub-mountain belts on the foot hills of Siwalik alluvial forms with coarse often pebbly soils known as “**Bhabhar**”. To its south occurs swampy lowland with silty soils known as “**Terai**”.

- 2. Black Cotton Soils:** This is also called regur soil. Main areas include Deccan Trap, Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Andhra Pradesh, Tamil Nadu, U.P. and Rajasthan. Black Soils are usually deficient in nitrogen, phosphate and humus but rich in Potash, lime, aluminum, calcium and magnesium. The soil is moisture retentive and it has a high degree of fertility. It is suitable for the cultivation of cotton, cereals, oilseeds, tobacco, groundnut and citrus fruits.

Black soils develop under semi-arid condition, in area covered with basalt. Colour of the black soils varies from deep black to light black or chestnut. The black colour is added due to the presence of “Titaniferous magnetite”.

They become sticky when wet due to high percentage of clay and develop cracks in hot sunny weather. Black soils are well known for their fertility. Since, the content of water soluble salt is high they are not suitable for heavy irrigation. Black soil regions are ideal for dry farming due to their moisture retentive quality.

- 3. Red Soils:** Occupies about 70% of the total area in Tamil Nadu, Chhotanagpur, few parts of Andhra Pradesh and Orissa.

Red soils develop generally on crystalline and metamorphic rocks rich in ferromagnesium minerals. Hence they are more sandy and less clayey. Red soils are found in area of comparatively low rainfall and so are less leached than the laterite soils. Red soils have a concentration of iron, absence of lime, Kankar, carbonates, humus, phosphoric acid and are neutral to acid reactions.

They are not retentive to moisture so cultivated mostly during the rainy season. These are favourable for the cultivation of pulses and coarse grains.

Crops: Rice, Ragi, Tobacco, Vegetables, Groundnut etc. on coarse soil for higher level; Sugarcane on heavy clay at lower level.

- 4. Laterite Soils:** They are formed under the conditions of high rainfall and temperature with alternate wet and dry periods. These soils are rich in oxides of iron and aluminum but poor in nitrogen, potash, phosphoric acid and lime content due to leaching; highly acidic in nature. These soils are concentrated in Vindhyan Plateau, Satpura, Mahadeo and Maikal ranges in Madhya Pradesh, Malabar Coast, Orissa coast and Meghalaya.

Laterite soils develop in the tropical regions which receive heavy seasonal rainfall. Heavy rainfall promotes leaching whereby lime and silica are leached away and soils rich in oxides of iron and aluminum are left behind. If the oxide of aluminum predominates the laterite soils, they are called “Bauxite”, the chief industrial ore of aluminum.

Laterite soils are red due to the presence of oxides of iron. They are poor in lime content hence acidic in nature. Laterite soils of high areas are very poor and least retentive to moisture. Sometimes they form the barren land topography. Laterite soils of low level areas hinder the process of laterization due to regular addition of soil washed down from the neighbouring high areas.

Crops: Rice, Ragi, Sugarcane, Tapioca, Chestnut etc.

5. **Forest Soils:** Humus predominates in forest soil but it is deficient in potash, phosphorous and lime. It is distributed over the Himalayan and other ranges in the north, Western Ghats, Eastern Ghats and Peninsula. Favourable for plantation crops e.g. tea, coffee spices and tropical fruits.
 1. **Podzols (At high Level):** They are formed under high acidic condition and found on higher slopes of Himachal Pradesh and Jammu & Kashmir. They are covered by coniferous forests. They are highly leached due to excessive moisture and are greyish brown in colour.
 2. **Brown Forest Soil (In warm temperate belt):** They are less acidic than podzol with high base status. They are rich in humus and fertile and extensively used for crop cultivation.
 3. **Alpine Meadow (In alpine zone of Himalayas):** They are dark coloured, either sandy-clay or sandy-loam. They contain mostly undecomposed plants.

6. **Arid and Desert Soils:** These soils, characterized by high salt and low humus content, are found in Rajasthan, Haryana, Punjab, Rann of Kutch, and other rain-shadow regions, since these soils consist of high phosphate, fertility increases with irrigation and by adding nutrients.

Desert soils are found in an arid and semiarid conditions in north-western part of India, west of Aravalli range. They are mostly friable and low in moisture content. They are rich in phosphate but poor in nitrogen and clay content (only 8%).

Crops: Very few crops especially Millets, Jowar, Bajra are grown for want of water supply.

7. **Saline and Alkali Soils:** Develop along arid region in small patches. Also called Reh, Kallar and Usar, they are infertile but can be reclaimed by good drainage. These soils are found in Rajasthan, Punjab, Haryana, U.P. and Bihar.

Saline and alkaline soils develop at places where desert condition prevails because of high rate of evaporation and very little leaching. Saline soils contain free sodium and other salts while alkaline soils have sodium chloride. Alkaline soils are deficient in calcium and nitrogen and are highly impervious and have very low water holding capacity.

Crops: Rice, wheat, cotton, sugarcane, tobacco etc. supported by irrigation. For better fertility application of lime and gypsum and cultivation of salt resistant crops like berseem, rice, sugarcane can be used.

8. **Peaty and Organic Soils:** Develop under result of accumulation of large quantity of organic matter. Highly saline and deficient in phosphate and potash and occur in central Orissa, Central Bihar, West Bengal and Tamil Nadu.

Peaty and Marshy soils originate in humid regions as a result of an accumulation of large amount of organic matters. They may contain considerable soluble salt and is called as “Kari”.

These areas are submerged under water during the monsoon season and as soon as rain ceases the land is put under paddy cultivation. These soils are black, heavy and highly acidic.

Soil Erosion

The destruction of soil cover is known as soil erosion. The main reasons of soil erosion are:

- (a) Deforestation
- (b) Over-grazing
- (c) Irrational cultivation (e.g., Jhoom cultivation in North Eastern India)
- (d) Floods
- (e) Winds

Soil Erosion in India: The areas which have suffered soil erosion in India are generally tracts having sparse vegetation cover like the badlands of lower Chambal and the Yamuna. The vegetation cover in these areas is sparse; hence, the running water cuts easily into the soil forming deep ravines. In many parts of the plain a high degree of slope induces similar erosion. The dry areas of Rajasthan and Haryana, on the other hand, lose their soil cover through wind erosion.

Soil Conservation: Soil conservation depends on the existing conditions. The most common methods, however, include afforestation, contour cultivation and scientific methods of cultivation keeping in view landform characteristics.

Rain water washes the calcium compounds and consequently it causes the lime deficiency in soils. Such soils are acidic and develop in area of heavy rainfall. Oxygen combining with iron compounds produces Iron-Oxide, red in colour and it gives the red colour to the soils.

Points to remember

Chemical weathering is more important in hot tropical climate. Hence, the Indian subcontinent is prone to chemical weathering.

Leaching is more important in area of heavy rainfall. It is the most common feature of hilly regions.

High temperature of India promotes active decay of vegetation and hence humus is destroyed. So, Indian soils are generally deficient in humus and require regular application of nitrogen rich fertilizer.

Titanium salt adds black colour to the soils of Indian Plateau.

Sedentary soil / in situ soil, produced after breaking of parent rocks underneath the surface, are usually very deep up to 15mt. or more on the Deccan Plateau.

Sedentary soils are: Black cotton soils, Laterite Red soil, Podzolic soil of forest, Saline and Alkaline soil, Peaty soil.

Drifted soils / Transported soils / Azonal soils are formed in situ but transported by agents and deposited in valleys and deltas.

Transport Trade and Communication

Transport and Communication facilities are necessary for the healthy growth of country. Road and rail transport are well developed in India with ample scope for the development of water transport. Ocean waterways are already well developed. Inland waterways require improvement.

Railways

Trains are the most important means of transport. They account for nearly three-fourth of the passenger traffic and four-fifth of the freight traffic in India. Indian railways system is the largest in Asia and the fourth largest in the world. It is the biggest departmental public undertaking in the country. It is also the world's second largest railway system under a single management. The first train in India steamed off from Bombay to Thane, a stretch of 34 km. in 1853. The network of railway has increased upto 63,465 km.

Gauges of Indian Railway

Gauge	Length	Route Track (km)	Running Track (km)	Total (km)
Broad Gauge	1.7 m	48,574	69,016	91,274
Metre Gauge	1m	11,834	12,429	15,236
Narrow Gauge	0.7 & 0.6 m	2,924	2,925	2,298
Total		63,332	84,370	1, 09,808

The Indian railways operate in three different gauges mainly-Broad Gauge, Metre Gauge and Narrow Gauge. The broad gauge accounts for nearly 50% followed by metre gauge 43% of the total route length. Railways are divided into 17 zones, headed by a General Manager who is responsible to the Railway Board for operation, maintenance and financial matters. Out of the 17 zones, Northern Railways having length 10,995 km is the longest route.

Container Service: Indian Railway has introduced a new marketing strategy of container services in 1980 with 7 container depots which in 1996 has expanded to 32 locations. The Container Corporation of India (CONCOR), a public sector undertaking, provide door to door services for domestic users, transportation in bulk for small customers and International transport in International Standards Organisation (ISO) containers.

Indian Railway Zones

Zones	Headquarters
Central	Mumbai, Victoria terminus
Eastern	Kolkata
Northern	New Delhi
North Eastern	Gorakhpur
North-East Frontier	Maligaon-Guwahati
Southern	Chennai
South Central	Secunderabad
South-Eastern	Kolkata
Western	Mumbai, Church gate
East Coast	Bhubaneswar
East Central	Hajipur
North Central	Allahabad
North Western	Jaipur
South Western	Bangalore
West Central	Jabalpur

Road Transport

India's road network is one of the largest in the world; the total length of the roads being more than 33 lakh km at present. Karnataka, with a total road length of about 64,000 km, leads followed by Madhya Pradesh and Uttar Pradesh. Roads are most suitable for short and medium distance. Other advantages include flexibility, reliability, speed and door to door service. For the purpose of maintenance and construction, roads are classified into:

National Highways, State Highways, Village Roads, Border Roads, International Highways.

There are about 30 National Highways connecting state capitals and have been constructed by the Central government. The present National Highway system includes a total length of 38517 km. It constitutes only 2% of total road length and carries nearly 40% of the road traffic. Some of the most important National Highways are listed below. Some important national highways are as follows:

NH No Route

1. New Delhi-Ambala-Jalandhar- Amritsar
2. Delhi-Mathura-Agra-Kanpur- Allahabad- Varanasi- Calcutta.
3. Agra- Gwalior- Nasik- Bombay
4. Thana and Madras via Pune and Belgaum
5. Calcutta and Madras
6. Calcutta – Dhule
7. Varanasi – Kanyakumari
8. Delhi -Bombay (Via Jaipur, Baroda & Ahmedabad)
9. Bombay – Vijayawada
10. Delhi – Fazilka
11. Jaipur – Bikaner
12. Ambala - Kalka - Shimla - Rampur – Chini (Indo-Tibet Border)
13. Delhi - Bareilly - Lucknow

The National highways No-7 is the longest highways of India. At present India has 5 express highways. They are:

Western

Eastern

Between Calcutta and Dumdum

Between Sukinda mines and Paradeep

Between Durgapur and Calcutta.

The Plan of Super National Highways: After the National Highways, there is a plan under the consideration of Central Road Transport Ministry to create Super National Highways. Through these Super National Highways of about 14,000 km length, there is a plan to link big sea ports of the country

with important cities. In the building of these Highways, the role of Private Sector will be important. This will be done on the basis of BOT (Build Operate Transfer) by Private Sector.

The National Highway Authority of India (NHAI) was constituted under the National Highway Authority of India Act 1988 and was made operational in February 1995. Initially it was entrusted with the task of implementing five externally aided NH improvement projects. Subsequently it has been mandated to implement the National Highways Development Project (NHDP) comprising 4/6 Lanning of 13252 km of national highways having two components:

- (a) The Golden Quadrilateral connecting Delhi-Mumbai-Chennai-Kolkata-Delhi and
- (b) North-South and East-West corridors (7300 km.), connecting Srinagar to Kanya Kumari and Silchar to Porbandar, respectively.

14 New National Highways

Highway No.	Length(km)	State
NH-81	100	Bihar, W. Bengal
NH-82	130	Bihar
NH-83	130	Bihar
NH-84	60	Bihar
NH-85	95	Bihar
NH-86	360	U.P., M.P.
NH-87	83	U.P.
NH-88	115	Himachal Pradesh
NH-89	300	Rajasthan
NH-152	40	Assam
NH-212	250	Kerala, Karnataka
NH-213	130	Kerala
NH-214	270	Andhra Pradesh
NH-215	348	Orissa
Total	2411	

Ports

There are 11 major ports and 148 minor working ports in India. Major ports are the direct responsibility of the Central government while minor ports including the intermediate ports fall in the concurrent list of the Indian Constitution and are managed and administered by the respective maritime state governments.

Major Ports on the Western Coast : Kandla (Gujarat); Mumbai (Maharashtra); Marmagao (Goa); New Mangalore (Karnataka); Cochin (Kerala); Jawaharlal Nehru Port (Nhava Sheva, Maharashtra).

Major Ports on the Eastern Coast: Tuticorin (Tamil Nadu); Chennai (T.N.); Vishakhapatnam (Andhra Pradesh); Paradeep (Orissa) and Calcutta -Haldia (West Bengal).

Among major ports, Mumbai is the biggest. Kandla is a tidal port. Marmagao enjoys the second position by value of the tonnage of traffic, bulk of which is export of iron ore. Visakhapatnam is the deepest, land locked and protected port. Chennai has an artificial harbour. Calcutta is a riverine port. Haldia has a fully equipped containerized berth.

Shipping: Overseas shipping has an extremely important role to play in India's international trade. The country has the largest merchant shipping fleet among developing countries and ranks 17th in the world in shipping tonnage.

Air Transport

The major international airports are Delhi (Indira Gandhi International Airport - Palam); Kolkata (Dum Dum, now Netaji Subhash Chandra Bose International Airport); Mumbai (Santa Cruz, now Chhatrapati Shivaji International Airport); Chennai (Meenambakam); Amritsar International Airport; Guwahati (Lokpriya Gopinath Bordoloi International Airport); Ahmedabad (Sardar Vallabhbhai Patel International Airport); Hyderabad (Rajiv Gandhi International Airport); Cochin International Airport; Bengaluru International Airport; Goa International Airport and Trivandrum International Airport (Thiruvananthapuram). Besides, there are 87 aerodromes and 20 civil enclaves maintained by Civil Aviation Department. The Civil Aviation Centre in Fursatganj near Allahabad provides, among other things, ground training to the pilots.

Air India established in 1953 is having bilateral air services agreement with 90 countries as on Jan 1, 1998.

Indian Airlines started its operations from 1st August, 1953, with a fleet of 99 aircraft and was the outcome of the merger of seven former independent airlines, namely Deccan Airways, Airways-India, Bharat Airways, Himalayan Aviation, Kalinga Air Lines, Indian National Airways and Air Services of India. After being granted permission from the Government of India, on 15 July 2007, Indian Airlines and Air India merged and started to operate as a single entity. A new company called National Aviation Company Ltd was registered by the government to amalgamate the two airlines along with their low-fare subsidiaries- Air India Express (of Air India) and Alliance Air (of Indian). Post-merger the new airline will be renamed as Air Indian.

Pawan Hans Limited basically provides helicopter support services to oil sector, hill station and remote areas. It also provides air support services to several customers which includes ONGC, Punjab, M.P., Lakshadweep Administration, GAIL, BSF and also caters to private sector.

Private Air Taxi: The liberalization process in civil aviation took wing in April 1990 with the cargo open skies policies.

National Waterways

- The Inland Waterways Authority of India was set up on October 27, 1986. This statutory body has the responsibility of development, maintenance and regulation of national waterways.
- The Government has identified 10 important waterways for consideration to declare them as National waterways. The followings have so far been declared as National Waterways and the same are being developed for navigation by Inland Waterways Authority of India.
- The Ganga between Allahabad and Haldia (1620 km) on October 27, 1986,
- The Sadia-Dhubri-stretch of river Brahmaputra (891 km) on October 26, 1988 and
- The Kollam-Kottapuram stretch of west coast canal (168 km) along with Champakara canal (14 km) and Udyogmandal canal (22 km) in Kerala
- Kakinada - Puducherry stretch of canals and the kalu velly Tank.
- Talcher - Dhamra stretch of river Brahmani.
- Lakhipur to Bhangra of river Barak

Posts & Telegraphs

The first Indian postal stamp was issued in 1852 in Karachi. The Postal department was set up in 1854 when nearly 700 post offices were already functioning. Today, there are about 1, 53,454 post offices. For the efficient and correct handling of the volume of mail, a numerical postal address code, known as the Postal Index Number (PIN), was introduced with digits which help to identify and locate every departmental delivery post offices excluding branch post offices.

Telecommunication services were introduced in India soon after invention of Telegraph and telephone. First telegraph line between Calcutta and Diamond Harbor was opened for traffic in 1851. By March 1884, telegraph messages could be sent from Agra to Calcutta.