Unit IV

Phytogeography

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Intro:-

Phytogeography or plant geography is a science which deals with the distribution of plants on or near the surface of the earth and water.

On the basis of area of the earth surface occupied by the plants, the various taxa are catagorised as under,

1. Wides
2. Endemics
3. Discontineous species.

(1) Wides:- plants widely distributed over the earth in definite climatic zones and in different continents are reffered to as wides.

Taraxacum officinale and chaenopodium album are the common examples of wides.

(2) Endemics:- plant species restricted to definite small regions are reffered to as endemics.

The important factors responsible for endemism are as follows,

(i) Endemics may be the survivers of once widely distributed ancestral forms.

For ex., Ginkgo biloba (restricted to China and Japan), sequoia sempervirens (confined to coastal valleys of California, U.S.A.)

(ii) The other endemics may be modern species which have had not enough time for occupying a large area through migration. ex:- Piper nigrum (Piperaceae), Ficus religiosa (Moraceae), shorea robusta (Dipterocarpaceae). These are the well known endemic species of Indian flora.

(c) Discontineous species :- These are the plants which occur at two or more distant places separated by oceans, hundreds or thousands of miles apart. such a distribution is called discontineous or disjunct.

* Bio-geographical regions of India.

- vegetation of any place is modified by the environmental factors; climate, geology and biotic factors.
- Indian subcontinent area has wide range of climate and corresponding diversity in the vegetation.
- Hooker (1907) was the first who contribute to analyze the vegetation of India.
- Later chatterjee (1939) analyzed the vegetation of India.

He modified the Hooker's scheme and recently, India (after partition) has been divided into the following botanical provinces by D. chatterjee (1962).

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1. Western Himalayas.
2. Eastern Himalayas.
3. Indus plain
4. Gangetic plain.
5. central India.
6. Deccan.
7. Malabar
8. Assam
9. Bay Islands of Andaman and Nicobar

1. Western Himalayas :-

- The northern part of our country is bounded by highest ranges of Himalayas which is one of the imp. botanical regions of the world.
- The climate and vegetation ranging from tropical near the low altitudes and temperate arctic types at the high altitudes.
- The northern mountain division can divided into western, central and eastern zones.
- Western Himalayas consist of north Kashmir, south Kashmir, a part of punjab and Kumaon. The average annual rainfall in this region is from 100 to 200 cm.
- Snowfall occurs in this region during winter season.
- The region may be divided into three subzones,

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(i) submontane zone or lower region or tropical and subtropical belts. (upto about 1500 m. altitudes from sea level
(ii) Temperate zone
(from 1500 meter to 3500 m)
(iii) Alpine zone (above 3500 metres)

(i) Submontane zone or Lower region

- It includes outer Himalayas, particularly regions of siwaliks and adjoining areas where annual average rainfall is over 100 cm.
- This zone ranges bet^n 300 metres and 1500 metres.
- In this zone, forests dominated by timber trees of Shorea robusta are common. other important tree species are Salmalia malabaricum, Butea monosperma, Acacia catachu and Zizyphus species.
In the swampy areas, Dalbargia Sisso (shisham), Eugenia jambolana are common in occurrence.
In west dry regions, the xeric plants particularly zizyphus & Acacia are common.

(ii) Temparate zone :-

- It commonly ranges at the altitudes from 1500 to 3500 mettes above the sea level.
- Oaks are dominant along with Popilas, Rhododendron, Betula and Pyrus.

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Cedrus deodara, Taxus baccata, Picea, Abies are found in the heavy rainfall region.
- In cultivated dryland of punjab, wheat and barley are main crops.
- In west kashmir, rice cultivation is common. Keshar or saffron, apples, peaches, walnut, almonds and other fruits are important economic plank of kashmir region.

(iii) Alpine zone:-

Above the altitude of 3500 metres and upto snowline (About 5000m) is alpine zone.
- The vegetation consists of evergreen conifers and some low and broad leaved trees.
- population of Draba, Braya, Cortia, Leontopodium go on increasing with the increase in altitude.

Poa, stipa and Fectuca are common grasses of alpine zone.

[2] Eastern Himalayas

- Eastern Himalayas extend from SIKKIM to upper ASSAM and Darjeeling
- Vegetation of this region differs from that of western Himalayas.
- The chief differences are due to changed environmental factors as heavy monsoon rainfall, less snowfall and high temperature.
- This region can be divided into,

(i) Tropical or submontane zone
(ii) Temperate or ~~MONTH~~ montane zone
(iii) Alpine zone.

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(i) Tropical or submontane zone :- (1800 m altitude)
- This zone is characterized by warm and humid conditions.
- In this zone mostly sal forests and mixed deciduous forests consisting of important plants, such as sterculia, Terminalia, Bauhinia are common.

(ii) Temperate or montane zone :-
- It may be further divided into upper and lower zones.
- Lower temperate zone is the region between 1800 and 3000 metre altitudes.
- In the lower temparate zone oaks, cedrela, Michelia, pyrus are common plants.
- In upper temperate zone (3000-4000 meter altitude) conifers and Rhododendrons are common.

(iii) Alpine zone

- Climate is humid and extremely cold.
- The vegetation is characterized by complete absence of trees and predominance of shrubs.
- Imp plants of this zone are Rhododendron and Juniperus.

Eastern Himalayan ~~region~~ vegetation is considered to be one of the richest vegetational units in the world and consists of several species of plants which are native of foreign contries such as china, Japan, Burma, and Malaya.

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[3] Indus plains:-

- It includes part of punjab, Rajasthan, Cutch, Delhi, a part of Gujrat and some part of this plain is now in pakistan.
- The climate of this zone is characterised by dry hot summer and dry cold winter.
- Rainfall is usually less than 70 cms, but in certain regions it is as low as 10-15 cms.
- The soil except cultivated land, is saline.
- Much of the land has become desert due to excessive dryness.
- Vegetation is mainly bushy and thorny. Acacia arabica, Prosopis spicigera, Salvadora and capparis decidua are very common plants of this region.

[4] Gangetic plains:-

- This is one of the richest vegetational zones in India. This zone covers flat land part of Delhi, whole of U.P., Bihar, West Bengal and also a part of Orissa.
- Rainfall in this zone is from 50 cm to 150 cm.
- ~~The~~ A great part of the land is under cultivation. The common crop plants are wheat, barley, maize, sorghum (jawar), bajra, urad, moong, tur, til, sugarcane, pea, gram, potato, rice, etc.
- In Western part of U.P. dry decideous and shrubby forests are common.

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- In eastern gangetic plain, the conditions are cold and wet (annual rainfall 150 cm in West Bengal). In this part, evergreen forests are common.

[5] Central India :-

- Central India covers Madhya pradesh, part of Orissa, Guirat and Vindhya. The areas are hilly.
- The average rainfall per annum may be 100-170 cm.
- Biotic disturbances are very common in this area which have led to the development of the thorny vegetation in open areas.
- In this region, teak is very common. other trees are Acacia species Terminalia tomentosa, Mango, phyllanthus, etc.

[6] Deccan :-

- This region comprises whole of the southern peninsular India including satpura and southern part of Godavari river.
- Average annual rainfall in this region is about 100 cm
- It may be divided into the following sub-divisions,
  (i) Deccan plateau
  (ii) Coromandel coast

- In Deccan plateau, teak forests containing Diospirous, Acacia, santalum album (chandan tree) and cedrela toona are common.
- In chota Nagpur plateau, important species are Clematis natans, Barberis and also many members of Annonaceae, Compositae, Apocyanaceae, Orchidaceae.
- In coromandal coast vegetation some halophytic species are there.

7 Western Coast of Malabar :-

- This is a small botanical province covering cape comorin to Gujrat and western ghat.
- This is a region of heavy rainfall.
- In this zone, 4 types of forests are common.

(i) Tropical forests (occur at 700m altitude).
(ii) Mixed deciduous forest (found at the altitude upto 1600 m).
(iii) Temperate evergreen forests (occur at more than 1200m altitude) and
(iv) Mangroove vegetation.

- In tropical evergreen forests the trees are tall. Important species are cedrela toona, Mangifera indica, sterculia alata, Artocarpus hirsuta, etc.
- In the mixed deciduous forests important plants are Terminalia tomentosa, Terminalia peninculata, Tectona grandis, Dalbergia and bamboo species.

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- Important plants of Nilgiri vegetation are Rubus, Rhododendron arboreum, Barberis, Ranunculus, potentilla. Many other herbs alongwith many grasses are also common.
- Temparate forests commonly called as "sholas" contain Gardenia obtusa, Michelia nilgirica. Eugenia species are also common.
- In Malabar, plants belonging to family Teliaceae, Annacardiaceae, Meliaceae, Myrtaceae, orchidaceae and many ferns are common. The west coast of Malabar region receives very high rainfall.
- In the coastal region mangroove plants grow luxuriantly.

[8] Assam :-

- This botanical province is very rich in vegetation and covers valley of Brahmputra, Naga hills and Manipur.
- This is the region of heaviest rainfall. Cherapunji is one of the rainiest places of the world. where annual rainfall often exceeds 1000 cm.
- Excessive wetness and high temperature in this zone are responsible for the development of dense forests.
- Broad leaved tall evergreen angiosperms and some conifers are very common. common plants occuring in this region are Ficus, Artocarpus, Michelia, champaca,

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Stercularia alata, Morus species. Besides these, Bamboos, canes, climbers and green bushes are also common.
Orchids and fern species are very rich in this zone.

[9] Bay Islands of Andman and Nicobar (India)

- These bay islands represent elevated portions of submarine mountains.
- climate is humid in the coastal region.
- In Andaman, beech forest, evergreen forests ~~and~~ semievergreen forests, deciduous forests and mangroove vegetation are of common occurrence.
- Rhizopora, Mimusops, Calophyllum, etc. are common plants in mangroove vegetation. The important crops are paddy and sugarcane.

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* Biodiversity hotspots of India.

Intro :-

- Biodiversity is the variety of plant and animal life in a particular habitat.
- It is the collection of flora and fauna of a place.
- Biodiversity hotspot is a region which is a prime location for the existance of rich biodiversity but also faces the threat of destruction.
- It is ~~the~~ a place which needs our immediate and constant attention to survive and thrive in the future as well.

Biodiversity hotspots in India

Some of the biodiversity hotspots ~~in~~ are present in India which includes,

① The Western Ghats and ~~Sriranka~~ Sri Lanka :-

- These hills are present along the Western edge of peninsular India. Since they are situated near the ocean, they are likely to receive a good amount of rainfall.
- Most of the deciduous, as well as rainforests are present in this region.
- Around 77% of the amphibians and 62% of the reptiles found here cannot be spotted elsewhere in the world.

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Environmental pollution

Intro :-

- pollution may be defined as the presence of extraneous materials in a particular environment in concentrations that are harmful to living organisms. or
- It may defined as the addition of material to water, air or land which adversely affect the natural quality of the environment.
- A pollutant is a toxic agent like germs in sewage, chemicals in the effluents, pesticides of agriculture, gases of the air.
- Though pollution by natural processes are known it is the man made pollution which poses a real threat to the mankind.

* Air pollution

- The combustion of fossil fuels (coal, oil, gas, etc. for releasing their stored energy is most challenging air pollution problem.
- combustion releases carbon dioxide, carbon monooxide, sulphur dioxide, nitrogen oxide, fluorides, hydrocarbons, etc. into the atmosphere.
- In addition to these major pollutants traces of ethylene, acetylene and propylene are also released which constitute a problem of air pollution. to sensitive plant species.
- Polychlorinated biphenyls (PCBs) are worldwide environmental contaminents.

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A brief account of the air pollutants is given below,

(i) Carbon dioxide:-

- It is chiefly produced in the combustion of the fuel in the homes, factories, power stations, etc. It is also produced by plants and animals in the process of respiration.
- Though photosynthesis of green plants balances the ratio of CO_2 and O_2 of the atmosphere, the amount of CO_2 content of atmosphere has gone up increasing which impairs the health of individuals but is also responsible for increasing the atmospheric temp. by trapping the radiation of sun. which results in warming of the earth.
This will cause melting of the polar ice caps resulting in increase in the sea level.
- Low lying areas and coastal regions all over the world will be flooded and will go under water.

(ii) Carbon monoxide:-

- It is produced from incomplete fuel combustion, mostly in the steel industry, in solid waste disposal, in oil refineries and in motor vehicles.
- It is a highly poisonous gas.

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(iii) Sulphur dioxide :-

- This gas produced in large scale around the industrial cities.
- Coal burning in power houses and other places accounts for 60% of the SO_2 pollution while refining and combustion of petroleum products for 20.7%.
- SO_2 is largely absorbed by large bodies of water and goes into the soil along with precipitation.
- High concentrations of SO_2 causes rapid disappearance of chlorophyll (chlorosis) breakdown of cells and development of necrosis.

(iv) Fluorides :-

- Fluoride containing rocks, soils, minerals on heating release the extremely phytotoxic gas hydrogen fluoride in the atmosphere.
- Fluoride enters the leaves through the stomata and gets accumulated in their tips and margins
- Necrosis and chlorosis on the tips and margins are characteristic injury symptoms on the leaves.

(v) smog :-

- A combination of smoke and fog denotes fog smog causes glazing, silvering, bronzing and sometimes necrosis of the lower leaf surfaces of sensitive species resulting in serious crop losses.

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(vii) Ozone :-

- In metropolitan cities the inefficient internal combustion engines of automobiles release tons of waste hydrocarbons and nitrogen oxides into the atmosphere.
- The action of ultraviolet light on nitrogen oxide results in the formation of ozone.
- Ozone damages leafy vegetables, cereals, textile crops, shrubs, ornamentals, fruit and forest trees.
- Ozone toxicity symptoms appear as flecks, streak, tip burn and also involves premature yellowing of the foliage.

(viii) Nitrogen oxides :-

- Nitrogen and oxygen combine together at high temperature to produce nitrogen oxides.
- It is also released by aircrafts, furnaces, forest fires, etc.
- NO_2 is known to cause necrotic stem lesions, defoliation, dieback and even death of certain plants.

(viii) Ethylene :-

- Ethylene is an unsaturated hydrocarbon. It is released from automobile engines, combustion of natural gases, coal, or wood and from incomplete combustion of almost every organic substance.

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- Excessive ethylene accelerates respiration causing premature senescence and abscission.
- Ethylene is very injurious to orchids and other greenhouse crops. It orchids it causes dry sepal injury, failure of buds to open and the occurrence of yellow leaves.

Other air pollutants :-

are gaseous ammonia, chlorine and aerosols - suspended solid and liquid particles.

Acid rain :-

- Sulphur oxides and nitrogen oxides are added to the atmosphere daily in very large quantities as a result of burning of fossil fuels.
- These oxides get converted in strong acids viz., sulphuric acid and nitric acids because of interactions in the atmosphere.
- These acids are brought down to the earth with the rains and bring out a change in the pH of the soil.
- Due to acid rain there is reduction in growth rates and salmon and trout fishes have disappeared from the country's streams and lakes as a result of fall in the pH caused by acid rains.

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* Water Pollution

- Many of the wastes of human society are disposed of in the bodies of water, rivers, lakes, oceans and some of the wastes disposed of in air or land may enter the bodies of waters.
- water pollution is dengerous not only the aquatic ecosystems but even the lives of the animals on the land are severely threatened.
- The pollutants found in water are,

① Domestic sewage :-

- sewage containing human faeces, urine, kitchen washings, cloth washings, etc. is usually released in rivers on the banks of which most of the cities are situated.
- The drinking water obtained from such rivers have to be excessively chlorinated to kill the dangerous bacteria, germs and other contaminants.
- pollution by untreated domestic sewage causes serious oxygen depletion in estuaries, seas and lakes. The molluscan shellfishes of such places are unsafe for human consumption.

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(2) Surface run off :-
- Minerals and organic wastes are carried to the lakes, rivers and the seas from agricultural fields where nitrogenous and phosphate fertilizers, pesticides and herbicides are given throughout the year.
- Water from such lakes have become deoxygenated and toxic and can no more support aquatic life and become 'dead.'

(3) Industrial discharges :-
- Industrial wastes are the biggest contributor to water pollution. They include many toxic materials like heavy metals, acids, alkalies, cyanides, etc.

(i) Murcury :- Murcury is released as wastes of chlor-alkali industry, from electrical and paint manufacture, mining and refining processes the pulp and paper industry and from combustion of fossil fuels.

(ii) ~~Lead :- Lead is~~
- It is highly toxic and said to be converted into mono methyl murcury and di methyl mercury which produce nervous disorders in marine animals.
- consumption of Hg contaminated fishes may be hazardous to man. Human beings feeding on such poisoned animals develop a crippling deformity called minamuta disease.

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(ii) Lead :- Lead is the natural pollutant of water, air and biosphere.
- Lead is accumulating in the marine environment as a result of ~~drani~~ drainage from rocks, industrial and domestic sources particularly the use of anti-knock motor fuels containing lead compounds.
- Lead is a cumulative poison that affects enzymes and impairs cell metabolism.
- It accumulates in drinking water.

(iii) Copper and Zinc :- are also released as industrial wastes. No toxic effects of copper and zinc on consumers have yet been recorded.

- In Japan, the marine pollution in the coastal areas due to industrial discharges has become so acute that fisherman living on contaminated fishes have developed serious diseases.
- The birds preying on fishes are dying and are in danger of extinction.
- In India, river pollution near big cities is on the increase and several cases of mass scale death of fishes have been reported.
- In 1969, the Jamuna near Delhi was contaminated by industrial discharges from the Ghaziabad industries to such a large extent that hundred of thousands of fishes died and floated on the surface of water of the river.

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(iv) Radioactive wastes :-

- Liquid radioactive wastes are released into the sea around nuclear installations.
- Nuclear tests are being performed on high seas.
- The oceanic currents carry the radioactive contaminants everywhere.
- The minute radioactive atoms, molecules, or ions get into all the aquatic organisms through the food chains. Fishes and other organisms become unfit for human consumption.
- Man is thus destroying sea's natural productivity, the vast reserve of plant food and fishes which are so essential for the existence of man in this age of population explosion.

* Control of water pollution

- Most cities of world have evolved certain engineering systems such as septic tanks, oxidation ponds, filter beds, waste water treatment plants and municipal sewage treatment plants for the removal of various pollutants from the sewage before it is tripped into river or sea.
- It is essential to have modern sewage treatment plants for every town and city of India so that all the pollutants can be removed from it and pure water obtained for recirculation.
- Currently a weed water hyacinth has come into prominence for purifying domestic and industrial waste water. The plant regenerates

rapidly and has a capacity to accumulate heavy and even radioactive metals.
In India, the enactment of "prevention and control of water pollution act" in 1974 has helped to prevent water pollution.
A number of highly hazardous pollutants are black listed and their discharge in the sea is strictly prohibited.
The waste water polluted with cyanides and heavy metals can be purified by certain bacteria. Million of these bacteria are introduced in such waste water plants.

* Control of Air pollution

(1) prevention on burning of leaves and trash
(2) prevention and control of vehicular pollution :- for controlling the air pollution because of vehicles, following measures are adopted,
(a) Using new proportion of gasoline and air.
(b) More exact time for fuel feeding
(c) Using gas additives to improve combustion.
(d) By injecting air into the exhaust to convert exhaust compounds into less toxic substances.
(e) Correcting the engine design, ~~and~~ for

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(3) Use of filters :- Filters can be used to capture and recycle the escaped gases (hydrocarbons) from the engine.

(4) Prevention and control of Industrial Pollution :- To check the air pollution by industrial and power plant chimney wastes, measures are taken for the removal of particulate matter and gaseous pollutants.

(5) Control of air pollution through law :-
In our country there have been several measures to prevent and control different types of air pollution.

- The Environment (protection) act 1986
- The motor vehicles act, 1988. came into force - 1.7.1989
- The air (prevention and control of pollution Act (1981). It was amended in 1987.

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* Soil or Land pollution

- The land pollution is caused by solid wastes and chemicals.
- some common soil contaminants, their sources and impacts on the biota are given below,
- The heaps from mines bear the destructive effects on environment.
- Areas around smelting and mining complexes are soiled by metals such as calcium, zinc, lead, copper, arsenic and nickel. These are not only phototoxic even in small amounts but also are unsafe for human and animal consumption.
- The maior sources of land pollution are the industries such as pulp and paper mills, sugar mills, oil refineries, power and heating plants, chemical and fertilizer manufacturing unit, iron and steel plants, Plastic and rubber producing complexes, etc.
- Huge amount of solid wastes are either dumped, burnt or emptied into rivers and seas.
- Most industrial furnaces produce a grey, powdery residue of unburnt material known as fly ash.
- The fly ash, cinders, solid wastes and litter all are thrown away by industries and form huge mounds which spoil the landscape.

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- Households also contribute a large amount of solid rubbish in the form of domestic wastes. Some of the ex's are groceries, food scraps, vegetable remains, packing materials, cans, paper, bones of dead animals, plastics, polythene bags, glass, aluminium, rubber, leather, etc.
- some man-made materials can be used again such as paper, scrap metals, polythene, plastic but the majority of these cannot be reused.
- All these go to constitute heaps of municipal refuse. If they are not properly disposed it becomes unhygienic. Such places often become a home for rats, flies, masquitoes, bacteria and many other vectors, which may spread numerous human diseases.

* control measures

- It should be neccessory for the industries to install collectors to remove the particulate wastes (fly ash) from the chimneys.
- The garbage, instead of burning in the open, can be used not only to produce energy but also as filler for cement, bricks, asphalt and pavings.
- Another simplest method is crude tipping or open dumping used in most cities in India. More satisfactory is controlled tipping or the sanitory landfill, which is recently used in Delhi for solid waste disposal.

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In sanitory landfill, a layer of about 2 meters of refuse is covered by atleast 23 cm. of earth, ash or other inert material, up to the level of the hole chosen. The chosen holes may be low lying watery areas and ditches. The land, thus, reclaimed can be used for making gardens, parks, playground or apartment complexes.
By this method the volume of refuse is reduced and some of the refuse is more quickly biodegraded.

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* Soil Erosion and soil conservation

Intro :-

Soil is a store house for organic and inorganic plant nutrients and water.

- The soil is subjected to a continuous and simultaneous depletion or loss and addition of soil resources. The various soil components are being removed by living organisms and are returning to the soil by way of death and decay of organisms on it.
- If the rate of removal or loss of components is greater than the rate of addition, the soil will become less fertile.

* Soil Erosion

- The word 'erosion' means to wearing away.
- In soil erosion, fertile soil surfaces are detached and removed from their original places and are deposited at some other places.
- Thus soil erosion is the removal of soil from its upper part.

Agencies causing soil Erosion

Soil erosion is caused by the following two agencies,

1. Climatic
2. Biotic

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(a) Climatic agencies causing erosion of soil :-

These are water and wind

(a) Water :-

Water is an important factor in soil erosion. snow and melting snow also remove the top soil. soil is directly affected by heavy rainfall, rapidly running water and by wave action.

Erosion caused by water may be of the following types,

(i) Sheet erosion :-

Uniform removal of a thin layer of soil from large area is called sheet erosion. It is caused due to run-off of rain water.

(ii) Rill Erosion :-

In this type of soil erosion, heavy rainfall and rapidly running water produce finger-shaped grooves or rills over the entire field.

(iii) Gully erosion :-

It is more prominent type of erosion in which heavy rainfall, rapidly running water and transporting water may result in deeper cavities or grooves called gullies.

(iv) Landslides or slip erosion :-

This type of soil erosion is caused by heavy rainfall and it occurs in slopy lands, such as mountains and hills.

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In this type of erosion when the running water percolates through the crevices of rocks great masses of soils and loose rocks lying on the steep slip downwards.

(v) Stream bank erosion :-

During the rainy season when fast running water streams take turn in some other directions, they cut the soil and make caves in the banks.

As a result of this large masses of soils become detached and washed away from the banks.

(b) Wind :-

Removal of soil by wind is called wind erosion. stormy winds carry the soil particles to distant places. ~~and~~

Wind currents usually remove the top soil which is fertile and full of humus and minerals.

Wind causes the following three types of soil movements, viz : (i) saltation (ii) suspension and (iii) surface creep.

(i) Saltation :-

soil particles of 1 to 1.5 diameters move up from the soil surface, generally in vertical direction under the influence of direct pressure of stormy wind.

Major part of wind carried soil is moved in a series of bounces, called saltation.

(ii) Suspension :-

In this, there are fine soil particles (diameter less than 1 mm) are suspended in air. These suspended particles are kicked up when particles of saltation strike on the soil. The soil particles are deposited at distant places.

(iii) Surface creep :-

In this, there are larger particles ranging from 5-10 mm in diameter. Because they are too heavy to move in saltation, they creep on surface of soil.

(2) Biotic agencies causing soil erosion :-

Excessive grazing, deforestation, undesirable forest biota and mechanical practices by man are important factors which cause soil erosion.

(3) Other factors :-

(i) Fields on steep slopes are cultivated and top soil is washed away by rains. The loss of soil is too much and the fields become uncultivable.

(ii) Forest fires are responsible for burning down forest trees on huge scale.

(iii) Over-grazing by cattle causes removal of vegetational cover of the soil.

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* Soil conservation

Conservation means prevention of wastage of natural resources, e.g. soil, water, plants and animals.

- soil conservation is believed to be only the control of soil erosion.

There are several ways of conserving soil:

(1) Reforestation :-

- The steep land of hills where soil erosion is severe, the need for soil conservation is maximum.
- Reforestation means planting suitable quick growing plants to give a proper plant cover is the easiest way for preventing erosion.
- The planting of shelterbelts and other wind-breaks prevents soil erosion by wind.
- In arid conditions soil binding species like saccharum munja, cynodon dactylon etc. are grown to check the shifting of sand.
- In our country van Mahotsav week is celebrated every year to emphasise the need of suitable plant cover in each and every place. Large number of trees are planted to make up for the recurring losses of natural vegetation.

(2) Counter planting :-

- On hill slopes there are many advantages of ~~cour~~ conter plowing.

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- plowing up and down the slope causes quick run off of water, and loss of top soil by sheet erosion and gullying.

(3) Contour strip cropping :-
- On contoured slopes clean-cultivated crops are planted between strips of cover crops, such as legumes which retard run-off of water and hold soil.
- The alternate strips of dense growing and soil covering crops prevent soil erosion.

(4) Terracing :-
- Another common method to prevent the run-off of water is the terracing of the slope.
- The slope is divided into series of small flat fields by means of ridges (terraces), which are placed in such a manner that they catch and hold water. This checks the run-off and allows water to soak in.
- This breaking up of long slopes into small watersheds channelises water to the sides of the fields and thus soil erosion is prevented.

(5) Basin Listing :-
- In certain special cases deep furrows are maintained (Listing).

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- Water and snow are held in these furrows in which crops are planted in the bottom. At regular intervals cross dams are made to further reduce the flow of water.

⑥ Dams :-

- Disastrous floods are annual features of many rivers. Floods bring havoc to the soil and vegetation of the plains. In such case soil erosion is severe. Big dams constructed in the headwaters of such rivers control the floods effectively.
- Soil erosion is prevented and due to better irrigational facilities the useless land become fertile and productive.

⑦ Controlled grazing :-

- Excessive grazing makes a land completely bare.
- The soil particles become compact under the impact of hoofs of animals. Rain water can't soak in such a soil and there is quick run-off. The soil ultimately becomes dry.
- The underground rhizomes, and roots of the plants become weak due to the absence of foliage and therefore, their holding capacity on the soil particles loosens. such a dry and weak top soil is easily eroded by the action of wind and water.

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(8) Soil fertility :-

- Fertile soil supports crops which again add the inorganic and organic content of the soil.
- sterile soil lacking minerals and humus etc. support poor vegetation.
- The humus content of the soil is low and, therefore, water holding capacity of the soil is also low. There is faster run-off and if there is no vegetation, it causes rapid soil erosion.

* Deforestation

(Destruction of Forests)

- Deforestation means destruction of forest.
- It is an alarming threat to the life and future of environment.
- The main causes of the deforestation in India are explosion of population, increased requirement of timber and fuel wood and enhanced grazing.
- other prominent causes of forest ~~dest~~ destruction are construction of roads along the mountain, dam building, urbanization, Industrialization, etc.
- The devastating effects of deforestation in India include soil, water and wind erosions.

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- Destruction of biotic potential of land also leads to desertification. Desertification is the process leading to desert formation.
- Removal of vegetational cover brings about marked changes in the local climates of the area. Thus deforestation, overgrazing, etc. bring about changes in rainfall, temperature, wind velocity, etc., and also leads to soil erosion.
- When forest die, ecological balance maintained by nature breaks away, and floods and droughts are the dangerous consequences.
- In the Himalayan range, the rainfall has declined 3-4%. due to deforestation.

* Afforestation

For the purpose of afforestation, following two types of methods of forestry are practiced.

(i) Conservation or protective Forestry :-
It includes following three strategies,

(a) Conservation or reserve forest :-
- These forests are the areas where our water regimes are located (e.g. Himalayas and Western and Eastern Ghats together).
- They also include National Parks, Sanctuaries, Biosphere reserves and all ecologically fragile areas.

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- In these areas, no commercial exploitation can be allowed. These areas, in fact, need protection from fuel-starved villages and fodder-starved cattle.

Chipco movement:-

- Chipco is a Hindi word which means to embrace or to hug.
  Hugging the trees is an age-old practice in the Himalayan region.
- In 1970, Gopeswar and some 20 villages of the Tehri-Garhwal district of U.P. were devastated by flash flood in the Alaknanda river. This flood occured due to deforestation and was an eye-opener for the villagers.
- The people of these villages under the leadership of Chandi prasad Bhatt pledged that they would not permit any more cutting of trees.
- The people (mostly women) started hugging trees (~~most~~ whenever forest contractors tried to cut them down.
- This movement become very successful and was popularised all over the world by sunderlal Bahuguna.
- Bahuguna presented the plan of this chipco movement for the protection of soil and water through ban on tree felling in the Himalayas at the meeting of UNEP (= United Nations Environment programme) held in London in June 1982.

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② Commercial or Exploitative forestry :-

- The basic aim of commercial forestry is to supply goods and services and meet the needs of local people for firewood, fodder, food, fertilizer, fibre, timber, medicines, etc.
- These forests also supply material for industrial purposes as timber of all types, plywood, match-wood, paper and pulp, etc.

This can be achieved by (i) intensive plantation and (ii) captive plantations.

(i) Intensive plantation :- This type of forestry includes planting all the available land from villagers fields to commercial land, to road/rail sides and every available space.
- It includes cultivation of indigenous or exotic species for plantation.
- Intensive plantations include two types of programmes : social forestry and agro-forestry.

(a) Social forestry
- This type of forestry started with NCA (National Commission on Agriculture) in 1976.
- There are two objectives in social forestry
(i) use of public and common land to produce firewood, fodder and timber for the local poor men and also to manage soil and water conservation. and
(ii) to releive pressure on conservation forests.

In our country, social forestry programme become quite successful particularly in Gujrat.

(b) Agro-forestry :- (Captive or production plantations).

- This is commercial forestry which is developed to fulfil the needs of the various forest-based industries requiring large quantities of raw materials.
- The captive plantation is done on the fallow land which is not being used for agriculture, mostly on ~~the~~ free grazing lands. A part of this plantation is used to produce fodder for the cattle.

Few more measures for the conservation forestry :-

Following strategy can be adopted to prevent further depletion of tree cover in the conservation forests,

(1) Tree-felling should be matched with tree-planting programmes.
(2) The use of firewood should be prevented. Other sources of energy such as biogas, solar energy, etc. have to be provided.
(3) A ban of 15-20 years should be imposed on commercial tree fellings in fragile areas of Himalayas and other hilly areas.
(4) Protection of standing forests should be done.
(5) An extensive afforestation programme with people's participation should be done.

Phytogeography

Question-Bank

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Q1:- Define phytogeography. Give an detailed account of phytogeographic regions of India. -- (15)

Q2:- What is meant by pollution? Give an detailed account of air pollution. -- -- (15)

Q3:- Define pollution. Give an detailed account of water pollution with control measures. -- (15)

Q4:- What is meant by conservation? Describe the different methods of soil conservation. -- (15)

Short notes

1) Acid rain
2) Soil pollution
3) Reforestation
4) Deforestation
5) Chipco movement
6) Agro forestry