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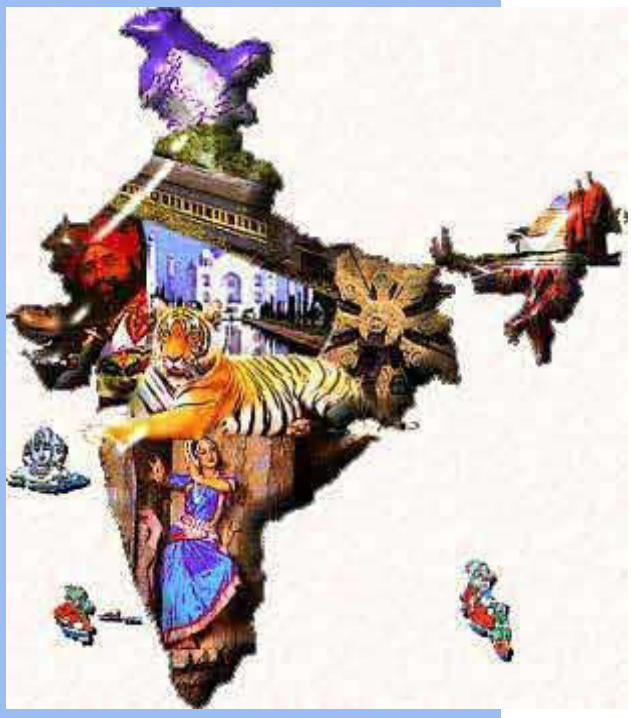

FREE

Soils in India

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Soils in India

Soil can be simply defined as a mixture of small rock particles/debris and organic materials/ humus which develop on the earth surface and support growth of plants.

Soil Classification – Urvara vs Usara

- In India, soil had been classified from the ancient period itself even though it was not as detail as the modern classifications.
- In the **ancient period,** the classification was based on only two things; whether the soil is fertile or sterile. Thus the classification were:

1. Urvara [fertile]
2. Usara [sterile]

Soil Classification – Agencies involved

- In the modern period, when men started to know about the various characteristics of soil they began to classify soil on the basis of texture, colour, moisture etc.
- When the **Soil survey of India** was established in **1956,** they studied soils of India and their characteristics.
- **The National Bureau of Soil Survey and the Land Use Planning**, an institute under the control of Indian Council of Agriculture Research did a lot of studies on Indian soil.

Alluvial Soils

- Alluvial soils are formed mainly due to silt deposited by Indo-Gangetic-Brahmaputra rivers. In coastal regions some alluvial deposits are formed due to wave action.
- Rocks of the Himalayas form the parent material. Thus the parent material of these soils is of transported origin.
- They are the largest soil group covering about 15 lakh sq km or about **6 per cent** of the total area.
- They support more than 40% of the India's population by providing the most productive agricultural lands.

Characteristics of Alluvial Soils

- They are **immature and have weak profiles** due to their recent origin.
- Most of the soil is Sandy and clayey soils are not uncommon.

- Pebbly and gravelly soils are rare. Kankar (calcareous concretions) beds are present in some regions along the river terraces.
- The soil is **porous** because of its loamy (equal proportion of sand and clay) nature.
- Porosity and texture provide good drainage and other conditions favorable for agriculture.
- These soils are constantly replenished by the recurrent floods.

Chemical properties of Alluvial Soils

- The proportion of nitrogen is generally low.
- The proportion of Potash, phosphoric acid and alkalies are adequate
- The proportion of Iron oxide and lime vary within a wide range.

Distribution of Alluvial Soils in India

- They occur all along the Indo-Gangetic-Brahmaputra plains except in few places where the top layer is covered by desert sand.
- They also occur in deltas of the Mahanadi, the Godavari, the Krishna and the Cauvery, where they are called deltaic alluvium (coastal alluvium)
- Some alluvial soils are found in the Narmada, Tapi valleys and Northern parts of Gujarat.

Crops in Alluvial Soils

- They are mostly flat and regular soils and are best suited for agriculture.
- They are best suited to irrigation and respond well to canal and well/tube-well irrigation.
- They yield splendid crops of rice, wheat, sugarcane, tobacco, cotton, jute, maize, oilseeds, vegetables and fruits.

Geological divisions of alluvial soils

- Geologically, the alluvium of the Great plain of India is divided into newer or younger khadar and older bhangar soils.

Black Soils

- The parent material for most of the black soil are the volcanic rocks that were formed in the Deccan Plateau (Deccan and the Rajmahal trap).
- In Tamil Nadu, gneisses and schists form the parent material. The former are sufficiently deep while the later are generally shallow.
- These are the region of high temperature and low rainfall. It is, therefore, a soil group typical to the dry and hot regions of the Peninsula.

Characteristics of Black Soils

- A typical black soil is highly argillaceous [Geology (of rocks or sediment) consisting of or containing clay] with a large clay factor, 62 per cent or more.

- In general, black soils of uplands are of low fertility while those in the valleys are very fertile.
- The black soil is highly retentive of moisture. It swells greatly on accumulating moisture. Strenuous effort is required to work on such soil in rainy season as it gets very sticky.
- In summer, the moisture evaporates, the soil shrinks and is seamed with broad and deep cracks. The lower layers can still retain moisture. The cracks permits oxygenation of the soil to sufficient depths and the soil has extraordinary fertility.

Colour of Black Soils

- The black colour is due to the presence of a small proportion of **titaniferous magnetite or iron and black constituents of the parent rock.**
- In Tamil Nadu and parts of Andhra Pradesh, the black colour is derived from crystalline schists and basic gneisses.
- Various tints of the black colour such as deep black, medium black, shallow black , a mixture of red and black may be found in this group of soils.

Chemical Composition of Black Soils

- 10 per cent of alumina,
- 9-10 per cent of iron oxide,
- 6-8 per cent of lime and magnesium carbonates,
- Potash is variable (less than 0.5 per cent) and
- **phosphates, nitrogen and humus are low.**

Distribution of Black Soils

- Spread over **46 lakh sq km (16.6 per cent of the total area) across** Maharashtra, Madhya Pradesh, parts of Karnataka, Telangana, Andhra Pradesh, Gujarat and Tamil Nadu.

Crops in Black Soils

- These soils are best suited for cotton crop. Hence these soils are called as **regur and black cotton soils.**
- Other major crops grown on the black soils include wheat, jowar, linseed, virginia tobacco, castor, sunflower and millets.
- Rice and sugarcane are equally important where irrigation facilities are available.
- Large varieties of vegetables and fruits are also successfully grown on the black soils.
- This soil has been used for growing a variety of crops for centuries without adding fertilizers and manures, with little or no evidence of exhaustion.

Red Soils

- Red soils along with its minor groups form the **largest soil group of India.**
- The main parent rocks are crystalline and **metamorphic rocks** like acid granites, gneisses and quartzites.

Characteristics of Red Soils

- The texture of these soils can vary from sand to clay, the majority being loams.
- On the uplands, the red soils are poor, gravelly, and porous. But in the lower areas they are rich, deep dark and fertile.

Chemical Composition of Red Soils

- They are **acidic** mainly due to the nature of the parent rocks. The alkali content is fair.
- They are poor in lime, magnesia, **phosphates, nitrogen** and humus.
- They are fairly rich in **potash and potassium.**

Color of Red Soils

- The red colour is due to the presence of **iron oxide.**
- When limestone, granites, gneisses and quartzites are eroded the clay enclosed within the rocks remains intact with other forms of non-soluble materials.
- In oxidizing conditions, rust or iron oxide develops in the clay, when the soil is present above the water table giving the soil a characteristic red colour.
- The colour is more due to the **wide diffusion** rather than high percentage of iron oxide content.

Distribution of Red Soils

- These soils mostly occur in the regions of low rainfall.
- They occupy about 3.5 lakh sq km (10.6 per cent) of the total area of the country.
- These soils are spread on almost the whole of **Tamil Nadu.**
- Other regions with red soil include parts of Karnataka, south-east of Maharashtra, Telangana, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Odisha, Chota Nagpur plateau; parts of south Bihar, West Bengal, Uttar Pradesh; Aravalis and the eastern half of Rajasthan (Mewar or Marwar Plateau), parts of North-Eastern states.

Crops in Red Soils

- The red soils are **mostly loamy** and hence **cannot retain water** like the black soils.
- The red soils, with the proper use of fertilizers and irrigation techniques, give good yield of cotton, wheat, rice, pulses, millets, tobacco, oil seeds, potatoes and fruits.

Laterite – Lateritic Soils

- Laterite soils are mostly the **end products of weathering.**
- They are formed under conditions of **high temperature and heavy rainfall** with alternate wet and dry periods.
- Heavy rainfall promotes **leaching (nutrients gets washed away by water)** of soil whereby lime and silica are leached away and a soil rich in oxides of iron and aluminium compounds is left behind.
- 'Laterite' means brick in Latin. They harden greatly on loosing moisture.
- Laterite soils are red in colour due to little clay and more gravel of red sand-stones.

Chemical composition of Laterite – Lateritic Soils

- Laterite soils are rich in **bauxite or ferric oxides.**
- They are very **poor** in lime, magnesia, **potash and nitrogen.**
- Sometimes, the **phosphate** content may be **high** in the form of **iron phosphate.**
- In wetter places, there may be higher content of humus.

Distribution of Laterite – Lateritic Soils

- Laterite soils cover an area of 2.48 lakh sq km.
- Continuous stretch of laterite soil is found on the summits of Western Ghats at 1000 to 1500 m above mean sea level, Eastern Ghats, the Rajmahal Hills, Vindhyan, Satpuras and Malwa Plateau.
- They also occur at lower levels and in valleys in several other parts of the country.
- They are well developed in south Maharashtra, parts of Karnataka etc. and are widely scattered in other regions.

Crops in Laterite – Lateritic Soils

- Laterite soils lack fertility due to **intensive leaching.**
- When manured and irrigated, some laterites are suitable for growing **plantation crops** like tea, coffee, rubber, cinchona, coconut, arecanut, etc.
- In some areas, these soils support **grazing grounds and scrub forests.**

Economic value of Laterite – Lateritic Soils

- Laterite and lateritic soils provide **valuable building material.**
- These soils can be easily cut into cakes but hardens like iron when exposed to air.
- As it is the end-product of weathering, it cannot be weathered much further and is durable.

Forest – Mountain Soils

- These soils occupy about 2.85 lakh sq km or 8.67% of the total land area of India.
- They are mainly **heterogeneous soils** found on the hill slopes covered by forests.
- The formation of these soils is mainly governed by the characteristic deposition of organic matter derived from forests and their **character changes with parent rocks**, ground-configuration and climate.
- Consequently, they **differ greatly even if they occur in close proximity to one another.**

Distribution of Forest – Mountain Soils

- In the Himalayan region, such soils are mainly found in valleys, less steep and north facing slopes. The south facing slopes are very steep and exposed to denudation and hence do not support soil formation

- Forest soils occur in Western and Eastern Ghats also.

Chemical properties of Forest – Mountain Soils

- The forest soils are very **rich in humus.**
- They are deficient in potash, phosphorus and lime.
- They require good deal of fertilizers for high yields.

Crops in Forest – Mountain Soils

- They are suitable for **plantations** of tea, coffee, spices and tropical fruits in peninsular forest region.
- Wheat, maize, barley and temperate fruits are grown in the Himalayan forest region.

Arid – Desert Soils

- The desert soils consist of **Aeolian sand** (90 to 95 per cent) and clay (5 to 10 per cent).
- They cover a total area of 1.42 lakh sq km (4.32%).
- The presence of sand inhibits soil growth. Desertification of neighboring soils is common due to intrusion of desert sand under the influence of wind [Aeolian sand].

Distribution of Arid – Desert Soils

- Occur in arid and semi-arid regions of Rajasthan, Punjab and Haryana. The sand here is blown from the Indus basin and the coast by the prevailing south-west monsoon winds.
- Sandy soils without clay factor are also common in coastal regions of Odisha, Tamil Nadu and Kerala.

Chemical properties of Arid – Desert Soils

- They are usually poor in organic matter.
- Some desert soils are **alkaline** with varying degree of soluble salts like **calcium carbonate.**
- Calcium content increases downwards and the subsoil has ten times more calcium.
- The **phosphate** content of these soils is as **high** as in normal alluvial soils.
- Nitrogen is originally low but some of it is available in the **form of nitrates.**

Crops of Arid – Desert Soils

- Phosphates and nitrates make these soil fertile wherever moisture is available.
- There is a possibility of reclaiming these soils if proper irrigation facilities are available.
- In large areas, only the drought resistant and salt tolerant crops such as barley, cotton, millets, maize and pulses are grown.

Saline – Alkaline Soils

- In Saline and Alkaline Soils, the top soil is **impregnated** (soak or saturate with a substance) with saline and alkaline efflorescences (become covered with salt particles).
- Undecomposed rock fragments, on weathering, give rise to **sodium, magnesium and calcium salts and sulphurous acid.**
- Some of the salts are transported in solution by the rivers.
- In regions with low water table, the salts percolate into sub soil and in regions with good drainage, the salts are wasted away by flowing water.
- But in places where the drainage system is poor, the water with high salt concentration becomes stagnant and deposits all the salts in the top soil once the water evaporates.
- In regions with high sub-soil water table, injurious salts are transferred from below by the **capillary action** as a result of evaporation in dry season.

Distribution of Saline – Alkaline Soils

- Saline and Alkaline Soils occupy 68,000 sq km of area.
- These soils are found in canal irrigated areas and in areas of high sub-soil water table.
- Parts of Andhra Pradesh, Telangana, Karnataka, Bihar, Uttar Pradesh, Haryana, Punjab (side effects of improper or excess irrigation), Rajasthan and Maharashtra have this kind of soils.
- The accumulation of these salts makes the soil infertile and renders it unfit for agriculture.
- In Gujarat, the areas around the Gulf of Khambhat are affected by the **sea tides** carrying salt-laden deposits. Vast areas comprising the estuaries of the Narmada, the Tapi, the Mahi and the Sabarmati have thus become infertile.
- Along the coastline, saline sea waters infiltrate into coastal regions during **storm surges** (when cyclones make landfall) and makes the soil unfit for cultivation. The low lying regions of coastal Andhra Pradesh and Tamil Nadu face this kind of soil degradation.

Peaty – Marshy Soils

- These are soils with **large amount of organic matter** and **considerable amount of soluble salts.**
- The most humid regions have this type of soil.
- They are black, heavy and **highly acidic.**

Distribution of Peaty – Marshy Soils

- Kottayam and Alappuzha districts of Kerala where it is called kari.
- Also occur in the coastal areas of Odisha and Tamil Nadu, Sunderbans of West Bengal, in Bihar and Almora district of Uttarakhand.

Chemical Properties of Peaty – Marshy Soils

- They are deficient in potash and phosphate.

Crops of Peaty – Marshy Soils

- Most of the peaty soils are under water during the rainy season but as soon the rains cease, they are put under paddy cultivation.

Characteristics of Indian Soils

- Most soils are old and mature. Soils of the peninsular plateau are much older than the soils of the great northern plain.
- Indian soils are largely **deficient in nitrogen, mineral salts, humus and other organic materials.**
- Plains and valleys have thick layers of soils while hilly and plateau areas depict thin soil cover.
- Some soils like alluvial and black soils are fertile while some other soils such as laterite, desert and alkaline soils lack in fertility and do not yield good harvest.
- Indian soils have been used for cultivation for hundreds of years and have **lost much of their fertility.**

Problems Of Indian Soils

- Soil erosion (Himalayan region, Chambal Ravines etc.), deficiency in fertility (Red, lateritic and other soils), desertification (around Thar desert, rain-shadow regions like parts of Karnataka, Telangana etc.), waterlogging (Punjab-Haryana plain) salinity and alkalinity (excessively irrigated regions of Punjab, Haryana, Karnataka etc.), wasteland, over exploitation of soils due to increase in population and rise in living standards and encroachment of agricultural land due to urban and transport development.

Soil Degradation

- Soil degradation is the decline in soil quality caused by its improper use, usually for agricultural, pastoral, industrial or urban purposes.
- Soil degradation is a serious global environmental problem and may be exacerbated by climate change. It encompasses physical (soil erosion), chemical (salinity and alkalinity, pollution) and biological deterioration (pollution and deterioration of vegetal cover).

Soil Erosion

- Soil erosion is the removal of top soil by agents like wind and water.
- Top soil has most of the nutrients necessary for a plant's growth. With depth, the fertility of the soil decreases. Thus, erosion results in reduction of fertility of the soil by washing away the fertile top layer.
- Erosion by wind and water is much quicker than the soil formation process. So once fertile soil layer is lost, it requires a lot of time and resources to restore it.
- Prevention is a more practical measure. It is less time and resource consuming.
- In India's case, the problem of soil erosion is particularly severe due to over dependence on agriculture and improper land management.
- Notable Quotable: **"Soil erosion is essentially a problem created by man and also faced by man himself."**

Water Erosion

- Water erosion leads to rilling, gullying, sheet-wash and rain peeling.
- If erosion continues unchecked for a long time, numerous finger-shaped grooves may develop in the silt laden soils. The whole pattern resembles the shape of a tree. This is called **rill erosion.**
- With further erosion of the soil, the rills deepen and become enlarged and are turned into Gullies formed over a large area gives rise to badland topography (Chambal Ravines).
- When a gully bed is eroded further, the bed gradually deepens and flattens out and a **ravine** is formed. The depth of a ravine may extend to 30 metres or more.
- Further erosion of ravine beds gives rise to Canyons are few hundred meters deep and wide. (Grand Canyon on Colorado River).
- When the entire top sheet of soil is washed away by water or by wind, leaving behind barren rock, it is called **sheet erosion.** Sheet erosion attacks a large area of top soil and renders the land almost unfit for cultivation.
- In the coastal areas, waves dash along the coast and cause heavy damage to soil. During the landfall of cyclones, storm surges destroy beaches and wash away the top layer. In estuaries, tidal bores cause extensive damage to the surrounding banks. This is called **sea erosion.**
- In the higher reaches of the Himalayan region, soil erosion is caused by sowing moving glaciers. This is called **glacial erosion.**

Wind Erosion

- Wind erosion or **Aeolian erosion** is quite significant in arid and semi-arid regions.
- Winds usually blow at high speeds in deserts due to absence of trees (physical obstruction).
- These winds remove the fertile, arable, loose soils leaving behind a depression devoid of top soil (the depression formation in deserts is the first step in Oasis formation. Oasis forms in depressions when there is underground water that gets accumulated above rocks).
- Desertification around desert regions is due to wind erosion.
- Wind erosion is accentuated when the soil is dry, soils are subjected to overgrazing and devoid of vegetation cover.
- Very fine and medium sands are moved by wind in a succession of bounds and leaps, known as
- Coarse sand is not usually airborne but rather is rolled along the soil surface. This type of erosion is called **surface creep.**
- Very coarse sand and gravels are too large to be rolled by wind, so wind-eroded soils have surfaces covered with coarse fragments larger than 1.00 mm in diameter. This kind of arid soil surface is known as desert pavement.

Extent Of Soil Erosion In India

- 80 million hectares or about one-fourth of our total area is exposed to wind and water erosion.
- One-eighth of land has undergone serious erosion.
- Wind erosion is a serious problem in arid and semi-arid parts of north west India.

- About one-ninth of land is subject to severe wind erosion in Rajasthan and adjoining areas of Punjab, Haryana, Gujarat and Western Uttar Pradesh.
- It is estimated that 34 lakh tonnes of fertile soils is removed by wind every year.
- The loss due to water erosion is 53.34 million hectares annually.

Factors affecting Soil Erosion

- Intensity and duration of rainfall,
- Wind speed,
- Nature of soil and the physiography,
- Strong winds in dry areas,
- Human density,
- Deforestation,
- Overgrazing,
- Faulty methods of agriculture,
- Diversion of natural drainage courses,
- Wrong orientation of roads and railways, embankments and bridges.

Effects of Soil Erosion

- Fertile top soil is eroded.

- Flooding and leaching result in loss of mineral nutrients.
- Ground water level is lowered.
- There is decrease in soil moisture.
-
- Frequency and intensity of floods and drought increases.
- Rivers, canals and tanks are silted and their water holding capacity decreases.
- The incidence and damaging power of landslides increases.

Deforestation

- Population explosion has created pressure on forest land and resources and this causes deforestation. Deforestation accentuates soil erosion (soil degradation).
- Roots of trees and plants bind the soil particles and regulate the flow of water, thus saving soil from erosion. Deforestation make soil vulnerable to wind and water erosion.
- The large scale damage to soil in Shiwalik range, the Chos of Punjab, the ravines of Chambal valley are due to deforestation.

Overgrazing

- During the rainy season, there is plenty of vegetation and animals get enough fodder.
- But during the dry period, there is shortage of fodder and the grass is grazed to the ground and torn out by the roots by animals.
- This leads to loose structure of the soil and the soil is easily washed away by rains.
- Moreover, soil is pulverized (reduce to fine particles) by the hoofs of animals, and thus proves detrimental to top soil when heavy showers fall on it.
- Soil erosion due to overgrazing is a common site in the hilly areas.

Faulty Methods of Agriculture

- Much of the soil erosion in India is caused by faulty methods of agriculture.
- Wrong ploughing, lack of crop rotation and practice of shifting cultivation are the most adversely affecting methods of agriculture.
- If the fields are ploughed along the slope, there is no obstruction to the flow of water and the water washes away the top soil easily.
- In some parts of the country, the same crop is grown year after year which spoils the chemical balance of the soil. This soil is exhausted and is easily eroded by wind or water.
- Shifting cultivation practiced in some areas in the north-eastern states. In this method, a piece of forest land is cleared by felling and burning of trees and crops are grown. The removal of the forest cover leads to the exposure of the soil to rains and sun which results in heavy loss of top soil, especially on the hill slopes.

Soil Salinity and Soil Alkalinity

- In Saline and Alkaline Soils, the top soil is **impregnated** (soak or saturate with a substance) with saline and alkaline efflorescences (become covered with salt particles).
- Undecomposed rock fragments, on weathering, give rise to **sodium, magnesium and calcium salts and sulphurous acid.**
- Some of the salts are transported in solution by the rivers.
- In regions with low water table (due to over irrigation in canal irrigated areas), the salts percolate into sub soil and in regions with good drainage, the salts are wasted away by flowing water.
- But in places where the drainage system is poor, the water with high salt concentration becomes stagnant and deposits all the salts in the top soil once the water evaporates.
- In regions with high sub-soil water table, injurious salts are transferred from below by the capillary action as a result of evaporation in dry season.
- In canal irrigated areas plenty of the water is available and the farmers indulge in over irrigation of their fields.
- Under such conditions, the ground water level rises and saline and alkaline efflorescences consisting of salts of sodium, calcium and magnesium appear on the surface as a layer of white salt through capillary action.
- Alkalinity implies the dominance of sodium salts, specially sodium carbonate.
- Although salts of alkali are somewhat different in their chemical properties from the salts of saline soils both soils occur in the same areas.
- Sandy soils are more prone to alkalinity and the loamy soils to salinity-alkalinity.
- It is estimated that about 80 lakh hectares of land (2.43% of the country's total area) is affected by the problem of salinity and alkalinity.
- Vast tracts of canal irrigated areas in Uttar Pradesh. Punjab and Haryana; arid regions of Rajasthan, semi-arid areas of Maharashtra, Gujarat, Andhra Pradesh, Telangana and Karnataka etc. are facing this problem.
- Although Indira Gandhi canal in Rajasthan has turned the sandy desert into a granary, it has given birth to serious problems of salinity and alkalinity.

Effects of salinity and alkalinity

- Salinity and alkalinity have adverse effect on soil and reduce soil fertility.

- Cultivation is not possible on saline soils unless they are flushed out with large quantities of irrigation water to leach out the salts.
- Choice of crops is limited to salinity tolerant crops like cotton, barley etc..
- Quality of fodder and food produced in poor in quality.
- Salinity and alkalinity create difficulties in building and road construction.
- These cause floods due to reduced percolation of water.

Steps to treat salinity and alkalinity

- Providing outlets for lands to drain out excess water and lower water table.
- Seal leakages from canals, tanks and other water bodies by lining them.
- Making judicious use of irrigation facilities.
- Improve vegetal cover to avoid further degradation by planting salt tolerant vegetation.
- Crop rotation..
- Liberal application of gypsum to convert the alkalies into soluble compounds.
- Alkali can be removed by adding sulphuric acid or acid forming substances like sulphur and pyrite.
- Organic residues such as rice husks and rice straw can be added to promote formation of mild acid as a result of their decomposition.
- Flushing the salt by flooding the fields with excess water. However, this practice can lead to accumulation of saline water in the downstream area.

Desertification

- Desertification is the spread of desert like conditions in arid or semi-arid areas due to man's influence or climatic change.
- A large part of the arid and semi-arid region lying between the Indus and the Aravali range is affected by spreading desert conditions.
- Desert soils suffer maximum erosion by wind. The sand carried by wind is deposited on the adjoining fertile lands whose fertility dwindles and slowly the fertile land start merging with the advancing desert.
- It has been estimated that the Thar Desert is advancing at an alarming rate of about 0.5 km per year.
- The process of desertification is attributed to uncontrolled grazing, reckless felling of trees and growing population. Climate change have also contributed to the spread of deserts.

Ecological implications of desertification

- Drifting of sand and its accumulation on fertile agricultural land.
- Excessive soil erosion by wind and to some extent by water.
- Deposition of sand in rivers, lakes and other water bodies thereby decreasing their water containing capacity.
- Lowering of water table leading to acute water shortage.

- Increase in area under wastelands.
- Decrease in agricultural production.
- Increase in frequency and intensity of droughts.

Measures of Controlling Desertification

- Intensive tree plantation in the transition zones.
- Mulching shifting sand dunes in deserts with different plant species. Mulches serve as an effective physical barrier to the moving sand.
- Grazing should be controlled and new pastures should be developed.
- Indiscriminate felling of trees should be banned.
- Alternative sources of fuel can reduce the demand for fuelwood.
- Sandy and wastelands should be put to proper use by judicious planning.

Waterlogging

- The flat surfaces and depressions results in waterlogging.
- Waterlogged soils are soaked with water accumulated during rainy season or due to leakage from various water sources.
- Extent of waterlogged soils is about 12 million hectares in India – half of which lies along the coast and the other half in the inland area.
- Waterlogging is believed to be one of the chief causes of salinity.
- Proper layout of drainage schemes is the only way to overcome the menace of waterlogging.
- The basic methods of removing excess water from waterlogged soils are (a) surface drainage and (b) vertical drainage.
    - Surface Drainage. Surface drainage involves the disposal of excess water over ground surface through an open drainage system with an adequate outlet.
    - Vertical Drainage. Any bore or well from which the underlying water is extracted is defined as vertical drainage. It works well in Indo-Gangetic plain where the pumped water is used for irrigating the neighboring regions.

Soil Conservation

- Soil conservation is the prevention of soil from erosion or reduced fertility caused by overuse, acidification, salinization or other chemical soil contamination.
- Soil erosion is the greatest single evil to Indian agriculture and animal husbandry.
- Notable Quotable from Kullar's Indian Geography: "With soil conservation people rise and with its destruction they fall. Neglect of soil is like killing the hen that lays the golden egg."

Crop Rotation

- Adopting sustainable agricultural practices is the most important measure to conserve soil.
- In many parts of India, a particular crop is sown in the same field year after year. This practice leads to exhaustion of certain nutrients in the soil making it infertile.
- Crop rotation is a practice in which a different crop is cultivated on a piece of land each year.
- This helps to conserve soil fertility as different crops require different nutrients from the soil. Crop rotation will provide enough time to restore lost nutrients.

- For example, potatoes require much potash but wheat requires nitrate. Thus it is best to alternate crops in the field.
- Legumes such as peas, beans, and many other plants, add nitrates to the soil by converting free nitrogen in the air into nitrogenous nodules on their roots. Thus if they are included in the crop rotation nitrogenous fertilizers can be dispensed with.

Strip Cropping

- Crops may be cultivated in alternate strips, parallel to one another. Some strips may be allowed to lie fallow while in others different crops may be sown.
- Various crops are harvested at different intervals. This ensures that at no time of the year the entire area is left bare or exposed.
- The tall growing crops act as wind breaks and the strips which are often parallel to the contours help in increasing water absorption by the soil by slowing down run off.

Use of Early Maturing Varieties

- Early maturing varieties of crops take less time to mature and thus put lesser pressure on the soil. In this way it can help in reducing the soil erosion.

Contour Ploughing

- If ploughing is done at right angles to the hill slope, the ridges and furrows break the flow of water down the hill.
- This prevents excessive soil loss as gullies are less likely to develop and also reduce run-off so that plants receive more water.

Checking Shifting Cultivation

- Checking and reducing shifting cultivation by persuading the tribal people to switch over to settled agriculture is a very effective method of soil conservation.
- This can be done by making arrangements for their resettlement which involves the provision of residential accommodation, agricultural implements, seeds, manures, cattle and reclaimed land.

Ploughing the Land in Right Direction

- Ploughing the land in a direction perpendicular to wind direction also reduces wind velocity and protects the top soil from erosion.

Mulching

- The bare ground (top soil) between plants is covered with a protective layer of organic matter like grass clippings, straw, etc.

Benefits

- Protects the soil from erosion.

- It helps to retain soil moisture.
- Reduces compaction from the impact of heavy rains.
- Conserves moisture, reducing the need for frequent watering.
- Maintains a more even soil temperature.
- Prevents weed growth.
- Organic mulches also improve the condition of the soil. As these mulches slowly decompose, they provide organic matter which helps keep the soil loose.

Contour barriers

- Stones, grass, soil are used to build barriers along contours. Trenches are made in front of the barriers to collect water.
- They intercept downslope flowing water and soil particles. These barriers slow down the water movement and reduce its erosive force. They also filter out and trap many of the suspended soil particles, keeping them from being washed out of the field.
- A long term advantage of barriers is that soil tends to build up behind them, creating a terrace effect. Barriers can be classified as live (strips of living plants), dead (rocks, crop residues), or mixed (a combination of the previous two).

Rock dam

- Rocks are piled up across a channel to slow down the flow of water. This prevents gullies and further soil loss.

Terrace farming

- In terracing, a number of terraces are cut along the hill slope.
- These are made on the steep slopes so that flat surfaces are available to grow crops. They can reduce surface run-off and soil erosion.

Contour Bunding

- Contour bunding involves the construction of banks along the contours.
- Terracing and contour bunding which divide the hill slope into numerous small slopes, check the flow of water, promote absorption of water by soil and save soil from erosion.
- Retaining walls of terraces control the flow of water and help in reducing soil erosion.

Intercropping

- Different crops are grown in alternate rows and are sown at different times to protect the soil from rain wash.

Contour ploughing

- Ploughing parallel to the contours of a hill slope to form a natural barrier for water to flow down the slope

Shelter belts or Windbreaks

- In the coastal and dry regions, rows of trees are planted to check the wind movement to protect soil cover.

Sand fences

- Sand fences are barriers made of small, evenly spaced wooden slats or fabric. They are erected to reduce wind velocity and to trap blowing sand. Sand fences can be used as perimeter controls around open construction sites to keep sediments from being blown offsite by the wind

Afforestation

- It includes the prevention of forest destruction along with growing new forests or increase area under forests.
- A minimum area 20 to 25 per cent of forest land was considered healthy for soil and water conservation for the whole country.

- It was raised to 33 per cent in the second five year plan – 20 per cent for the plains and 60 per cent for hilly and mountainous regions.

Checking Overgrazing

- Overgrazing accentuates erosion. During the dry period, there is shortage of fodder and the grass is grazed to the ground and torn out to the roots by animals. Soil is pulverized (reduce to fine particles) by the hoofs of animals. All this leads to weak top layer.
- So overgrazing needs to be checked to prevent soil erosion.
- This can be done by creating separate grazing grounds and producing larger quantities of fodder.

Dams

- Much of the soil erosion by river floods can be avoided by constructing dams across the rivers in proper places. This checks the speed of water and saves soil from erosion.
- But indiscriminate dam construction can worsen the condition by creating floods and landslides like it happens in the Himalayan region.

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