**Soil Word: derived from Latin word Solum**
**Edaphic : Soil is an Abiotic Factor and Key Natural Resources**

Soil -

- Uppermost weathered layer of the earth crust
- thin and top surface layer on the earth comprising mineral particles, organic matter and living organisms.
- **Pedology** is the study of soils in their natural environment.
- Every year, the **United Nations** celebrates 5th December as **World Soil Day.**

**Table 13.1 : Water on the Earth's surface**

| *Reservoir* | *Volume (Million Cubic km)* | *Percentage of the Total* |
|---|---|---|
| Oceans | 1,370 | 97.25 |
| Ice Caps and Glaciers | 29 | 2.05 |
| Groundwater | 9.5 | 0.68 |
| Lakes | 0.125 | 0.01 |
| Soil Moisture | 0.065 | 0.005 |
| Atmosphere | 0.013 | 0.001 |
| Streams and Rivers | 0.0017 | 0.0001 |
| Biosphere | 0.0006 | 0.00004 |

Soil Importance :

- Agricultural Productivity and Profitability
- Biodiversity support - Habitat
- Carbon sequestration and water storage
- Important for decomposition activity
- Environmental sustainability ; Ecological security; Ecosystem services
- Food Security

Land Ecosystems have more productivity than Aquatic Ecosystem :
Reason :

- Soil is Absent
- Limited Nutrient Availability in Aquatic Zone
- Limited Light Availability below photic zone, limiting photosynthesis

**FOUR MAIN CONSTITUENTS OF SOIL**

- 1. Mineral matter 45 % –
- 2. Organic matter 5 %– like Humus + Plant Roots+ Organism
- 3. Soil Air 25 &
- 4. Soil Water 25 %

IMPORTANCE OF SOIL:

- Provides essential nutrients to plants for growth and development .
- It holds moisture and water for long time.
- It serves as habitat for number of organisms including microorganisms.
- It provides heat, air and water to organisms growing in or over it.

Physical Properties of Soil :

- The colour of the soil is due to the parent rock, organic matter and minerals present in it.
- Soil Texture - refers to the proportion of different size of particles (sand, silt and clay) that comprise soil
- Soil Porosity, Soil Density, Soil Structure , Soil Temperature

Chemical Properties of Soil:

- Determine the fertility of soil
- Soil ph; electrical conductivity

Biological Properties of Soil : Soil Biota

- Different types of micro organisms thrive in soil
- Mice, crabs, snails, earthworms, mites, millipedes, centipedes, fungi, bacteria, actinomycetes, protozoa and nematodes are commonly found in soil.

- They feed on plant residues, and make channels and burrows in the soil, thereby, increasing aeration and enhancing the percolation of water due to their activities.
- Bacteria predominate neutral soils, while fungi are more in acidic soils.
- Moist and shady soils favour the growth of algae

How Soil Formed : Occur in two Stages

- From weathered material of parental rocks
- Pedogenesis : natural process of soil formation

WEATHERING

Is the process of mechanical disintegration and chemical decomposition of rocks through the actions of various elements of weather and climate.

Pedogenesis : Classified into Four Groups :

- Soil Enrichment - Organic Matter accumulation addition of materials due to lateral movement of water or upward movement ( capillary action)
- Soil Depletion- loss of surface minerals/ materials by - Erosion and leaching
- Translocation- vertical movement within the horizons ( Upward movement- capillary action and downward movement - leaching)
- Transformation- decomposition of minerals

Laterization : takes place in Humid Region- High Temp and Rainfall Regions ( bacteria activity High)

Podsolizationl - takes place in Cool and humid climate (acidic soil) - Coniferous / Boreal Forest / Taiga Forest (bacterial activity low)

Calcification: takes place in Savanna Climate ( nutrients translocated upwards)

Salinization or Alkalization - takes place in Hot desert ( extreme evaporation translocated salts upward - capillary action)

Gleization - takes place in water logged and anaerobic low oxygen conditions

Bioturbation: The mixing of soil by animals like earthworms and rodents

**SOIL TYPES:**

On the basis of formation of soil, two categories of soil

- Residual Soil - They are formed by weathering and pedogenesis of rock at a specific place.
- Transported Soil- After weathering the soil may be transported by geomorphic agents

Ex

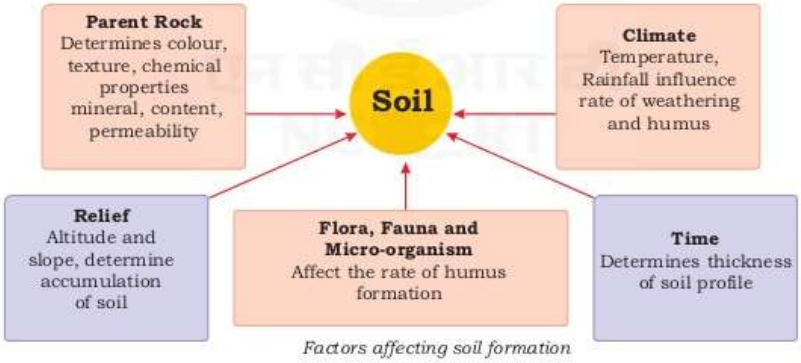
- Aluvial : Transported by water
- Colluvial : Transported by gravity
- Aeolian: Transported by wind ( sand dunes, loess- fine silt blown by wind)
- Glacial Soil or Till : Transported by slipping of glaciers
- Lacustrine Soil- Lake Sediments

**SOIL HEALTH CARD SCHEME :**

- launched in 2015
- Part of Ministry of Agriculture
- **Aim :** promoting soil test based and balanced use of fertilisers to enable farmers to realise higher yields at lower cost.
- It Provides information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility.
- It covers 12 Parameters/ Nutrients
- N,P,K (Macronutrients); S (Secondary- nutrient); Zn, Fe, Cu, Mn, Bo (Micro – nutrients); and pH, EC, OC (Physical parameters).
- Potential of Hydrogen (pH), Electrical Conductivity (EC), Organic Carbon (OC), Nitrogen (N), Phosphorus (P), Potassium (K), Sulphur (S), Zinc (Zn), Boron (B), Iron (Fe), Manganese (Mn) and Copper (Cu) of farm holdings.

**FACTORS OF SOIL FORMATION**

- Major Factors: Nature of Parent Rock and Climatic Factors
- Minor Factors: Topography, Role of Organic Material and Time Taken for composition of Soil Formation
- Active Factors : Climate and Organism
- Passive Factors: Parent Rock, topography and time
- All this differ from Place to Place.



*Factors affecting soil formation*

FACTORS RESPONSIBLE FOR SOIL FORMATION:

**Active factors**, whose influence over soil development, is directly observed. These include:

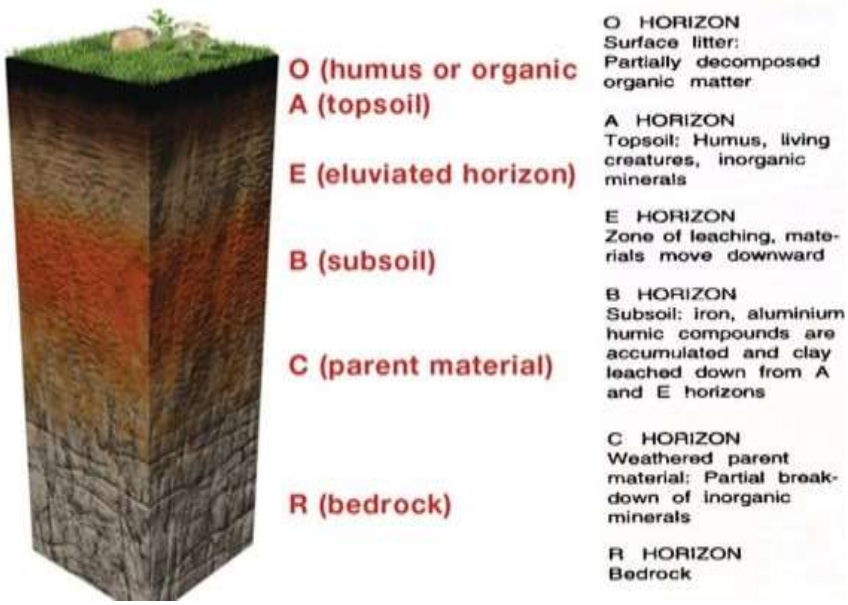
- Climate: Temperature and moisture affect the rate of weathering, organic decomposition and biological activity. The high rate of heat and humidity accelerates the microbial action, on the other hand colder and drier climate slows down these processes.
- Biosphere/Organism: Soil formation is influenced by organisms and microorganisms, burrowing insects, animals and humans as they add up to the soils.

**Passive factors**, as their effects are not immediately observed. They control how climate and organisms affect soil development and formation. These include:

- Parent material: Soil minerals are the basis of soil and they are produced from parent rocks through the process of weathering and other processes of natural disintegration. The type of parent rock and the conditions, under which it broke down, deeply influences the property of the soil.
- Topography/Relief: Topography and relief of a region affects the climatic conditions, which ultimately influences soil formation processes and its characteristics.
- Time: Young soils lose the characteristics of the parent material over time and acquire other features resulting from the addition of the organic matter and the activity of the organism. The most important feature of the soil is that they pass through a number of stages as they develop, resulting in a deep profile with many well-differentiated horizons.

CONCEPT OF SOIL PROFILE AND SOIL HORIZON

- Both are Cross Section
- A vertical section through different layers of the soil is called the soil profile
- A horizontal section of layers called Soil Horizon





**O Horizon :**

- Organic material Zone and Uppermost layer;
- formed in surface litter layer; (well developed in forest> Grasslands> Desert)
- generally dark in colour as it is rich in humus and minerals
- litter - undecomposed organic matter
- humus- fully decomposed organic matter

**A Horizon:**

- Top Soil Zone or Surface Soil;
- organic matter is mixed with mineral matter.
- Zone of living creatures

**E Horizon:**

- Eluviated Horizon
- Zone of Leaching or Lixiviation
- heavy materials move downward due to
- **leached** of clay, iron, and aluminium oxides.
- This loss of mineral and organic solutes caused by percolation is known as leaching

**Fourth Step : B Horizon : middle layer**

- Sub Soil
- 'Horizon B' is a transition zone between the 'horizon A' and 'horizon C', and contains matter derived from below as well as from above.
- Harder/ compact and lesser amount of humus but more of minerals.
- it his layer accumulates all the leached minerals from A and E horizon
- so called zone of Accumulation or Zone of illuviation

**Fifth Step :C Horizon** :

- Horizon C' is composed of the loose parent material.
- This layer is the first stage in the soil formation process and eventually forms the above two layers.

**Sixth Step R Horizon:** Parent Bedrock and largely comprise continuous masses of hard rock

Note:

- Mature Soil or Zonal = Well developed Soil Profile : Black, Red, laterite
- Immature Soil or Azonal : No well developed Soil Profile : Alluvial Soil
- In Ancient Time : fertile soil = **Urvara**
- In Ancient Time: Infertile soil or sterile = **Usara**

Zonal two main groups : On the Basis of Chemical Composition Soils are classified as

***Pedalfer is composed of aluminum and iron oxides and found in forest areas***

***Pedacol : calcium and found in dry areas***

Pedalfar : Found in Forest Areas/ Humid and Sub Humid like

- Red and yellow soil

- Laterite soil
- Prairie Grassland Soil
- Podzol ( acidic soil)
- Tundra

Pedocal : Found in Dry Areas

- Black soil / Chernozem
- Gray soil / Sierozem : desert and semi desert
- Brown soil

**Azonal Soil** –

- Have no well developed soil profile
- Because they have had insufficient time to develop or
- Slopes too steep to allow Profile development .
- developed by the process of deposition by the agents of erosion. like alluvial and loess soils.

Alluvial Soil, Recent Soil, Terai Soil, Glacier Soil, Delta and Coastal Soil

CLASSIFICATION OF SOILS

- India has varied relief features, landforms, climatic realms and vegetation types. These have contributed in the development of various types of soils in India
- Soil Survey of India, established in 1956, made comprehensive studies of soils in selected areas like in the Damodar Valley.
- The National Bureau of Soil Survey and the Land Use Planning an Institute under the control of the Indian Council of Agricultural Research (ICAR) did a lot of studies on Indian soils
- the ICAR has classified the Indian soils on the basis of their nature and character as per the United States Department of Agriculture (USDA) Soil Taxonomy

USA Taxonomy Based Soil - Region Chart

| SOIL NAME | REGION FOUND |
|---|---|
| Alfisol | Warm Humid Climate ( Forest soil/ Deciduous Forest ) |
| Andisol | Volcanic Region |
| Aridsol | Arid Region |
| Inceptisol | Young alluvial soil |
| Entisols | Young soil, flood plains, sand dunes, beaches |
| Gelisol | Permafrost or cold region |
| Histosols | Organic soil/ wetland soil |
| Mollisols | Grassland vegetation |
| Oxisols | Extremely Old Soil of Tropical regions / Equatorial region |
| Ultisols | Older Soil, Warm- humid climate, Red clay soil, Tropical rainforest |
| Spodsol | Cooler climate, Coniferous vegetation -acidic soil |
| Vertisols | Black Soil , wet and dry climate |

following order as per the USDA soil taxonomy

| Sl. No. | Order | Area (in Thousand Hectares) | Percentage |
|---|---|---|---|
| (i) | Inceptisols | 130372.90 | 39.74 |
| (ii) | Entisols | 92131.71 | 28.08 |
| (iii) | Alfisols | 44448.68 | 13.55 |
| (iv) | Vertisols | 27960.00 | 8.52 |
| (v) | Aridisols | 14069.00 | 4.28 |
| (vi) | Ultisols | 8250.00 | 2.51 |
| (vi) | Mollisols | 1320.00 | 0.40 |
| (viii) | Others | 9503.10 | 2.92 |
| | **Total** | | **100** |

*Source : Soils of India, National Bureau of Soil Survey and Land Use Planning, Publication Number 94*

On the basis of genesis, colour, composition and location, the soils of India have been classified into:

(i) Alluvial soils
(ii) Black soils
(iii) Red and Yellow soils
(iv) Laterite soils
(v) Arid soils
(vi) Saline soils
(vii) Peaty soils
(viii) Forest soils.


SOILS OF INDIA :

Black soil

- It is dark grey to black in colour and ranges from fertile to poor.
- These soils are also known as the Regur Soil‘ or the Black Cotton Soil‘.

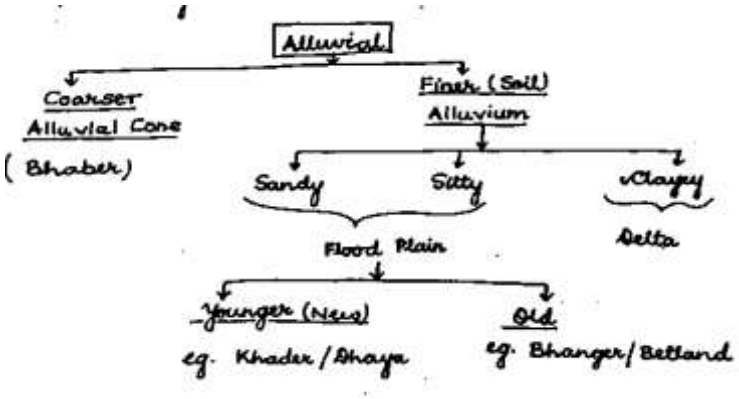
- Generally clayey, deep and impermeable
- The ph of black soil is 7.2 – 8.5
- The soil is rich in clay (montmorillonite) particles and has neutral to slightly alkaline reaction.
- The soil is rich in bases, lime and calcium.
- The soil is deficient in nitrogen, phosphate and organic matter but rich in potash, calcium and magnesium.
- It is soft when wet but forms hard blocks when dry and develops deep cracks.
- Thus, there occurs a kind of self ploughing'. Because of this character of slow absorption and loss of moisture, the black soil retains the moisture for a very long time, which helps the crops, especially, the rain fed ones, to sustain even during the dry season
- Black soil ranges from heavy clay (ill-drained) to loams (well-drained).
- Black soil is predominant in Maharashtra, Madhya Pradesh, western Andhra Pradesh, southern Tamil Nadu and northern Karnataka.

Red soil

- Red soil develops on crystalline igneous rocks in areas of low rainfall in the eastern and southern part of the Deccan Plateau.
- Along the piedmont zone of the Western Ghat, long stretch of area is occupied by red loamy soil.
- Yellow and red soils are also found in parts of Odisha and Chattisgarh and in the southern parts of the middle Ganga plain.
- The soil develops a reddish colour due to a wide diffusion of iron in crystalline and metamorphic rocks. It looks yellow when it occurs in a hydrated form.
- The fine-grained red and yellow soils are normally fertile, whereas coarse-grained soils found in dry upland areas are poor in fertility.
- They are generally poor in nitrogen, phosphorous and humus
- Such soil results from weathered material of metamorphic rocks.
- It is porous and friable neutral to acidic in reaction.
- Nitrogen, phosphate, lime and humus content are very low in this soil.
- It is found in parts of Tamil Nadu, Karnataka, north-east Andhra Pradesh, eastern parts of Madhya Pradesh, Bihar, West Bengal and Rajasthan.

Lateritic (laterite) soil

- Laterite has been derived from the Latin word Later which means brick
- The laterite soils develop in areas with high temperature and high rainfall. These are the result of intense leaching due to tropical rains
- Laterite soil is formed in areas receiving high rainfall with alternating wet and dry spells.
- This soil is red to reddish-yellow in colour.
- Heavy rains cause leaching of bases and silica from the surface of the soil.
- The soil shows acidic character with ph of 5 – 6 and is poor in nitrogen, phosphorus, potash, magnesium and lime.
- Such soil is porous and well-drained with poor water-holding capacity.
- Poor in organic matter, nitrogen, phosphate and calcium, while iron oxide and potash are in excess. Hence, laterites are not suitable for cultivation; however, application of manures and fertilisers are required for making the soils fertile for cultivation
- Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for tree crops like cashewnut.
- The laterite soils are commonly found in Karnataka, Kerala, Tamil Nadu, Madhya Pradesh and the hilly areas of Odisha and Assam




Alluvial soil

- The colour of the alluvial soils varies from the light grey to ash grey. Its shades depend on the depth of the deposition, the texture of the materials, and the time taken for attaining maturity. Alluvial soils are intensively cultivated.
- These soils cover about 40 per cent of the total area of the country.
- They are depositional soils, transported and deposited by rivers and streams.
- Rich in potash ; The soil is productive but may be deficient in nitrogen, phosphorus and humus
- Alluvial soil is ideal for horticultural crops.
- The soil greatly differs in colour, texture, drainage, presence or absence of sodium salts, etc. It is suitable for the cultivation of vegetables, flowers and fruits.
- The soil is found in all States of India along the rivers.
- The Indo-Gangetic soil is the best example of alluvial soil in India
- Two different types of alluvial soils have developed, viz. Khadar and Bhangar. Khadar is the new alluvium and is deposited by floods annually, which enriches the soil by depositing fine silts. Bhangar represents a system of older alluvium, deposited away from the flood plains.
- Both the Khadar and Bhangar soils contain calcareous concretions (Kankars).

DESERT SOIL

- Arid soils range from red to brown in colour.
- They are generally sandy in structure and saline in nature, they lack moisture and humus
- Desert soil is sandy soil and is found in low rainfall areas.
- Such soil is alkaline in nature with high pH value and is unproductive.
- It is rich in soluble salts, and poor in nitrogen and organic matter content.
- The physical conditions of the soil are unfavourable as it has low water-holding capacity due to high sand content.
- Desert soil is found in parts of Rajasthan.

FOREST AND HILLY SOILS

- These are shallow soils of higher and lower elevation on the hills.
- These are stony and infertile for the production of crops.
- loamy and silty on valley sides and coarse-grained in the upper slopes
- In the snow-bound areas of the Himalayas, they experience denudation, and are acidic with low humus content. The soils found in the lower valleys are fertile.
- These are low in bases and slightly acidic in reaction

SALINE AND ALKALINE SOILS

- Saline Soil ( Basic soil) : High salt content/ Organic matter high ph in between 7 to 8.5
- Alkailne Soil ( Basic soil) : Sodium content / Organic matter low ph greater than 8.5.
- They occur in arid and semi-arid regions, and in waterlogged and swampy areas
- Saline soil shows white incrustation of salts (chlorides and sulphates of sodium, calcium and magnesium) on surface due to high evaporation during summers.
- So Saline soil called " White Alkali Soil " which is infertile and poor in drainage.
- Alkaline soil is rich in carbonates and bicarbonates of sodium and is non-porous called as " Black Alkali Soil " or Usara Soil

- Saline soils are more widespread in western Gujarat, deltas of the eastern coast and in Sunderban areas of West Bengal. In the Rann of Kuchchh, the Southwest Monsoon brings salt particles and deposits there as a crust.
- In such areas, especially in Punjab and Haryana, farmers are advised to add gypsum to solve the problem of salinity in the soil.

PEATY AND MARSHY SOIL

- Found in the areas of heavy rainfall and high humidity, where there is a good growth of vegetation.
- This soil is highly acidic in nature and black in colour.
- Excessive wetness of the soil causes decay and degradation of dead vegetation, forming a layer of partially decomposed organic matter, resulting into peaty and marshy soil.
- Occurs widely in the northern part of bihar, southern part of uttaranchal and the coastal areas of west bengal, orissa and tamil nadu.

**Match the Columns**

| A | B |
|---|---|
| 1. Soil texture | (a) Ideal for horticultural crops |
| 2. Clay | (b) Acidic soil |
| 3. Low pH | (c) Finest soil particle |
| 4. Soil | (d) Size of soil particles |
| 5. Alluvial soil | (e) Holds roots and provides nutrition to plants |
| 6. Saline soil | (f) Highly acidic and black in colour |
| 7. Peaty and marshy soil | (g) High salt content |


**Image : Karewa Soil of Kashmir**

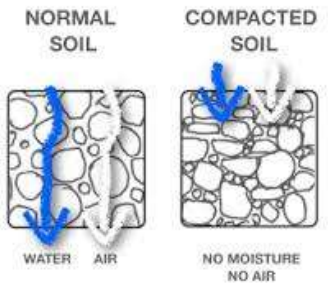
**Karewa soil:**

- are lacustrine deposits [deposits in lakes] in the Kashmir valleys region. ( Jhelum River)
- are **thick deposits of glacial clay and other materials embedded with moraines**
- Soft Soil ,Rich in Fossil,
- These Alluvial Deposits consist of Clay and Sand and Silt , Highly porous , moisture retaining capacity ( good for saffron farming : Safforn corm remains dormant for many months for that period of time it needs limited amount of moisture)
- Karewa formations are useful for the cultivation of Zafran is a local variety of Saffron in Kashmir valley. These are also important for the cultivation of almond, walnut, apple, and orchards.

Despite its agricultural and archaeological importance, karewas are now being excavated to be used in construction.

**ISSUE ABOUT SOIL IN INDIA :**

is the process in which stress applied to a soil causes densification as air is displaced from the pores between the soil grains.




**SOIL EROSION:**

- The destruction of the soil cover is described as soil erosion.
- *it is also called displacement of Upper Layer of soil*
- *it is one of the form of soil degradation*

- The soil forming processes and the erosional processes of running water and wind go on simultaneously. But generally, there is a balance between these two processes. The rate of removal of fine particles from the surface is the same as the rate of addition of particles to the soil layer.
- Wind and water are powerful agents of soil erosion because of their ability to remove soil and transport it.
- Wind erosion is significant in arid and semi-arid regions.
- In regions with heavy rainfall and steep slopes, erosion by running water is more significant.
- *Erosive Agents : for Soil Erosion are : Water , Ice= Glaciers , Snow, air/ Wind , plants and animal and Humans .*
- *reduce the fertility of the soil which leads to reduction in agriculture productivity and use of more fertilizers .*

**FOUR TYPES OF SOIL EROSION are caused by rainfall or water erosion**

- Splash erosion
- Sheet erosion
- Rill erosion
- Gully erosion

**FACTORS INFLUENCE SOIL EROSION IN INDIA ARE :**

- rainfall
- vegetation
- nature of soil
- wind velocity
- tillage- Tillage is the process of preparing soil for growing crops by mechanically breaking up the soil. It can involve digging, stirring, or overturning the soil.
- soil moisture
- slope topography

**FACTORS CAUSES SOIL EROSION:**

- Deforestation : major cause of Soil Erosion, make soil unlocked
- Faulty cultivation methods
- Over grazing
- Forest Fires
- Shifting Cultivation
- Climate Change
- Urban Sprawl
- Diversion of Natural drainage channels by railways embankments and roads



**SOIL DEGRADATION:**

- refers to the physical, chemical and biological decline in soil quality.
- The degree of soil degradation varies from place to place according to the topography, wind velocity and amount of the rainfall.
- Soil degradation is a global process

It can be:

- ✓ the loss of organic matter,
- ✓ Depletion of nutrients
- ✓ decline in soil fertility, and structural condition, erosion,

adverse changes in salinity, acidity or alkalinity, and the effects of toxic chemicals, pollutants or excessive flooding.

**Four types of SD:**

- water erosion,
- wind erosion,
- chemical deterioration (loss of nutrients or organic matter, salinisation, acidification, soil pollution, and fertility decline. leaching,)
- physical deterioration. (soil crusting, sealing and compaction

**SOIL DEGRADATION PRIMARY CAUSES ARE:**

- Deforestation
- Overgrazing and unsustainable agricultural practices
- Overexploitation for fuelwood
- Agricultural activities
- Increased flooding
- Industrialization and commercial pollution
- loss of arable land due to urban expansion

**THREATS**

- Climate Change
- Overgrazing
- acid rain and nutrient overloading
- Introduction to invasive alien species
- Loss of aboveground biodiversty
- agricultural practices
- pollution
- Fire
- Soil Erosion
- land degradation and desertification

**ISSUES AND CHALLENGES ASSOCIATED WITH SOIL IN INDIA**:

- **Soil erosion**: Soil erosion is a major concern in India, leading to the loss of topsoil, nutrients, and fertility. Factors such as deforestation, improper land use practices, and heavy rainfall contribute to soil erosion, adversely impacting agricultural productivity.
- **Soil degradation**: Overuse of chemical fertilizers, improper irrigation practices, and monocropping have led to soil degradation in many parts of India. Soil degradation results in a decline in soil fertility, loss of organic matter, and decreased water-holding capacity.
- **Salinization**: In arid and semi-arid regions, excessive irrigation and poor drainage can cause salt accumulation in the soil, leading to salinization. Salinization hampers plant growth and reduces agricultural productivity.
- **Soil pollution:** Pollution from industrial activities, untreated sewage, and excessive use of agrochemicals has resulted in soil and groundwater contamination in certain areas. Heavy metals, pesticides, and other pollutants can enter the food chain, posing risks to human health.
- **Soil acidification**: Excessive use of fertilizers, particularly urea, can lead to soil acidification. Acidic soils have a detrimental effect on crop productivity and nutrient availability.
- **Land degradation**: Urbanization, industrialization, and infrastructure development have led to the conversion of agricultural land into non-agricultural uses, resulting in land degradation. This conversion reduces arable land and affects food security.

- Lands with a slope gradient of 15 – 25 per cent should not be usedfor cultivation. If at all the land is to be used for agriculture, terraces should carefully be made.
- Over-grazing and shifting cultivation in many parts of India have affected the natural cover of land and given rise to extensive erosion. It should be regulated and controlled by educating villagers about the consequences.
- Contour bunding, Contour terracing, regulated forestry, controlled grazing, cover cropping, mixed farming and crop rotation are some of the remedial measures which are often adopted to reduce soil erosion

**SOIL CONSERVATION MEASURES :**

- The Process of protecting the soil from erosion to maintain its fertility

**Methods of Soil Conservation :**

- Mulching
- Terrace farming
- contour ploughing
- shelter belts
- rock dams
- Crop rotation

Mulching : Mulching is the process of covering the bare ground between plants with a layer of organic matter like straw.

**Categories of Mulching :**

- Organic : Mulching derived from sources like compost , dry grass , fall leaves saw dust , wood chips ,etc
- InOrganic : derived from plastic or other equivalent sources, and increase soil contamination issue.

It contributes

- in retaining soil moisture and
- suppressing weed control
- contributor / improving to soil fertility
- altering soil temperature
- prevent soil erosion
- improves soil nutrient and increase nutrient holding capacity ;
- reduce water and chemical consumption.;
- affects soil microorganism positively.
- reduce frequency of irrigation and reduce the impact of rain

it is one of the key components of Zero Budget Natural Farming (ZBNF).

**Intercropping :** In intercropping, different crops are grown in alternate rows and are sown at different times to protect the soil from being washed away by rain

**contour plouging :** Ploughing parallel to the contours of a hill slope to form a natural barrier for water to flow down a slope is called contour ploughing

**Terrace farming**

On the steep slopes, wide flat steps or terraces are designed so that flat surfaces are usable for cultivation, thus minimizing surface run-off and soil erosion.

- Contour ploughing and terrace cultivation is common along **mountains area**
- **The main difference between contour ploughing and terrace farming is the way in which the water flow is controlled**.
- Contour ploughing controls the water flow by furrows into the slope of the land. Terrace farming the water flow by creating level platforms on the land.
- Contour barriers : stones, grass, soil are used to barriers along contours. Trenches are made in front barriers to collect water .

cutting controls slope of the

build of the

**Shelter Belts**.

- Rows of trees that are planted in certain areas to check wind movement are called shelter belts.
- Found in Which region: in the coastal and dry region to check wind movement and to protect soil cover.

**Rock Dams**. This prevents gullies and further soil loss since rocks are piled up to slow

**Key Focus Should be on ( For Soil Conservation**)

- Nature based solutions / Traditional Knowledge
- Sustainable Practices : Organic Farming , Zero Budget Natural Farming
- Use of Scientific Technologies and Innovation like Precision Farming
- Afforest ration and Reforestation Measures

**KEY INTERVENTIONS :**

- **Promote sustainable agricultural practices** : crop-rotation, cover cropping, Mulching, organic farming, and reduced tillage, Agroforestry can enhance soil health while maintaining productivity.
- **Soil Restoration Initiatives**: Implementing restoration projects that focus on reforestation or afforestation can help restore degraded soils while improving local biodiversity.
- **Integrated Land Use Planning**: Encouraging integrated approaches that consider ecological principles when planning land use can minimize conflicts between development needs and conservation goals.
- **Community Engagement & Participation:** Involving local communities in decision-making processes regarding land use ensures key interventions .
- **Restoration of Natural Habitats**: Protecting existing natural habitats such as wetlands or forests helps maintain ecosystem services provided by healthy soils while supporting diverse biological communities.
- **Policy Frameworks**: Developing robust policies that prioritize sustainable land management practices is essential for protecting soil resources at national and global levels
- **Education & Awareness Programs**: Raising awareness about the importance of soil biodiversity among farmers, policymakers, and the general public can foster community engagement in conservation efforts
- Soil Testing and Monitoring
- **Regularly testing soi**l for nutrient levels and pH balance to make informed decisions about amendments and management practices that promote long-term health.

**To Conclude :**

Addressing these issues and challenges requires effective soil conservation and management practices. The government and farmers can adopt measures like contour plowing, terracing, crop rotation, agroforestry, and promotion of organic farming to reduce erosion, enhance soil fertility, and improve soil health. Ensuring sustainable land use practices and minimizing pollution can help protect this essential natural resource for future generations