

BASICS OF SOILS



Parent Material

- Soil formation depends upon the texture, structure as well as the mineral and chemical composition of the rock debris.
- **Nature, rate and depth of weathering** are important considerations under parent materials.
- Generally young soils or the lowermost horizon shows similarity with the parent material.

Topography

- The influence of topography is felt through the amount of **exposure of a surface to sunlight, drainage condition, and slope angle** etc.
- In middle latitudes pole-facing slopes may have slightly different soil conditions from equator-facing slopes due to poor exposure to sunlight.
- Soils on hillsides tend to be much better drained than those in valleys, where gleying may take place.

Climate

- Major influence in governing the rate and type of soil formation.
- The effect of **temperature** is to influence the rate of chemical and biological reactions.
- **Precipitation** has a major influence in governing the rate and type of soil formation.
- In **cool climates**, bacterial action is relatively slow while in **tropics**, bacteria thrive.
- Soil of hot tropical region show deeper profiles as compared to soils of cold tundra region.

FACTORS OF SOIL FORMATION:

Parent
Material



Topo-
graphy



Climate



Biota



Time





Biological Activity

- The vegetative cover and organism that occupy the parent materials from the start to later stages help in adding organic matter, moisture retention, nitrogen.
- Some organic acids which form during humification aid in decomposing the minerals of the soil parent materials.
- Humus accumulates in cold climate as bacterial growth is low and thus layers of peat develop in subarctic and tundra climates.
- Help in maintaining the fertility of soil by bringing bases (Calcium, Magnesium) from the lower parts of the soil into stems and leaves, and then releasing them into the upper soil horizons.

SOIL LAYERS AND SIGNIFICANCE

Soil

Parent Material

Topography

Climate

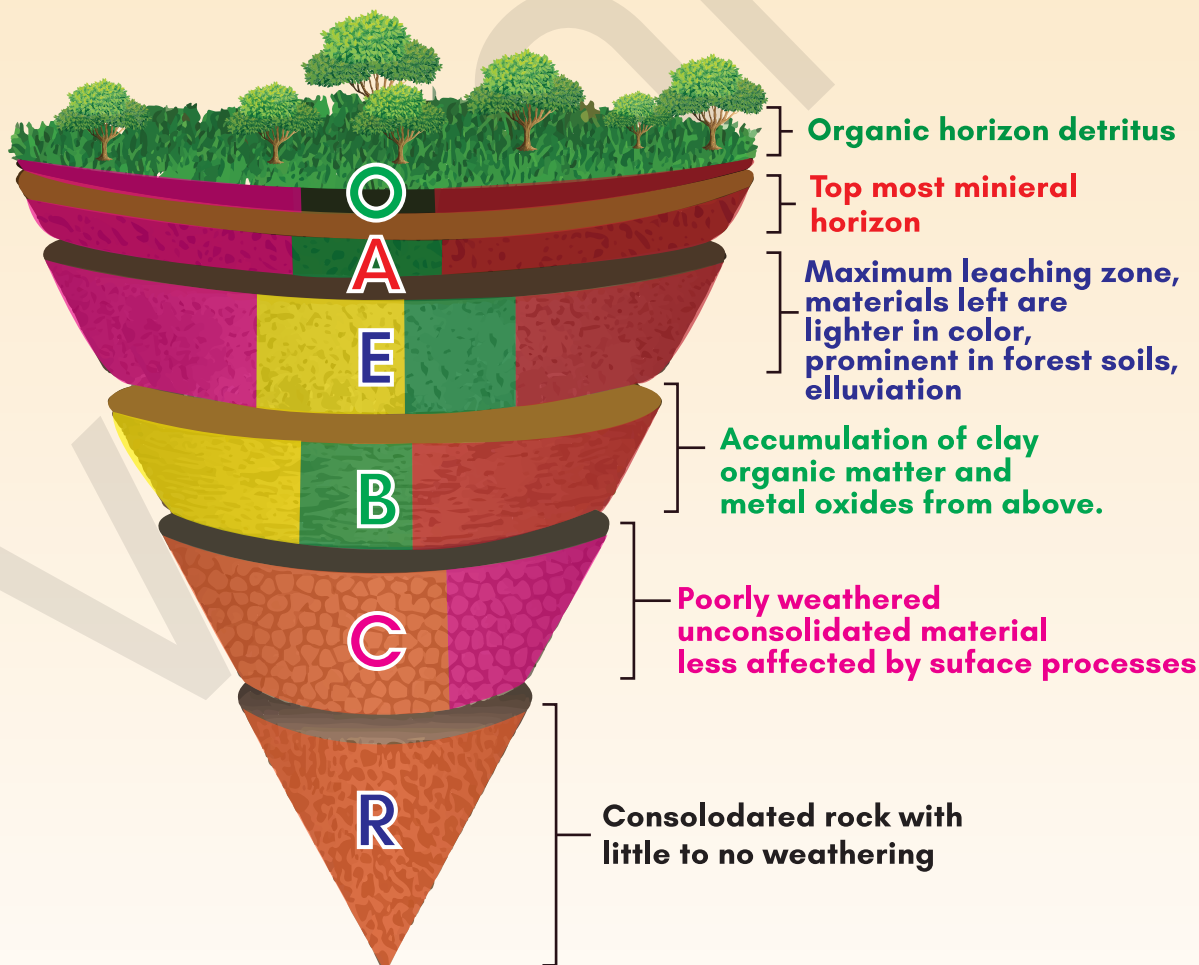
Biota

Time

Master Horizons

Result of net movement of materials.

Determine classification + Name + Uses of land



Parent Rock (Material that all upper layers originated from)
Regolith (Loose heterogenous material covering solid rock)
Solum (root depth)

Sub soil (rest of solum beneath top soil)
Top soil (organic, mineral horizon)



Three main classes of soil based on the zonal system

ZONAL	<ul style="list-style-type: none">● Well-developed soils which reflect the influence of climate as the major soil-forming factor.● Can be subdivided into Podzol soils, Tundra soils, Brown earth, Ferralsol, Chernozem, Chestnut and Prairie soils.
INTRA-ZONAL	<ul style="list-style-type: none">● Well-developed soils formed where some local factors such as parent material, terrain or age is dominant.● Can be subdivided into Calcimorphic soil (on calcareous parent material), Halomorphic soils (saline), and Hydromorphic soil (marshes, swamps or poorly drained upland).
AZONAL	<ul style="list-style-type: none">● Immature or poorly developed soils lacking a B-horizon. A-horizon lies immediately above the C-horizon of weathered parent material.● This may happen because of characteristics of parent material or nature of terrain or simply the lack of time for development.● Usually found on active flood plains, volcanic soils, newly deposited glacial drift, windblown sand, marine mud-flats.● Can be subdivided into Lithosol (erosion removes soil almost as fast as it is formed on steep slopes), Regosol (dry and loose dune sands) and alluvial soils (regular supply of sediments).

Soil Classification in India

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. ICAR has classified Indian soils into eight types **on the basis of their formation, colour, composition and location**.

Alluvial Soil	<ul style="list-style-type: none">● Formed by rivers by depositing sediments brought from the mountains.● The new alluvium is called Khadar while older deposited one is called Bangar. Khadar is renewed annually with fresh floods.● Alluvial soils are most widespread in the northern plains and the covers about 40 percent of the total area of the country.● Through a narrow corridor in Rajasthan, they extend into the
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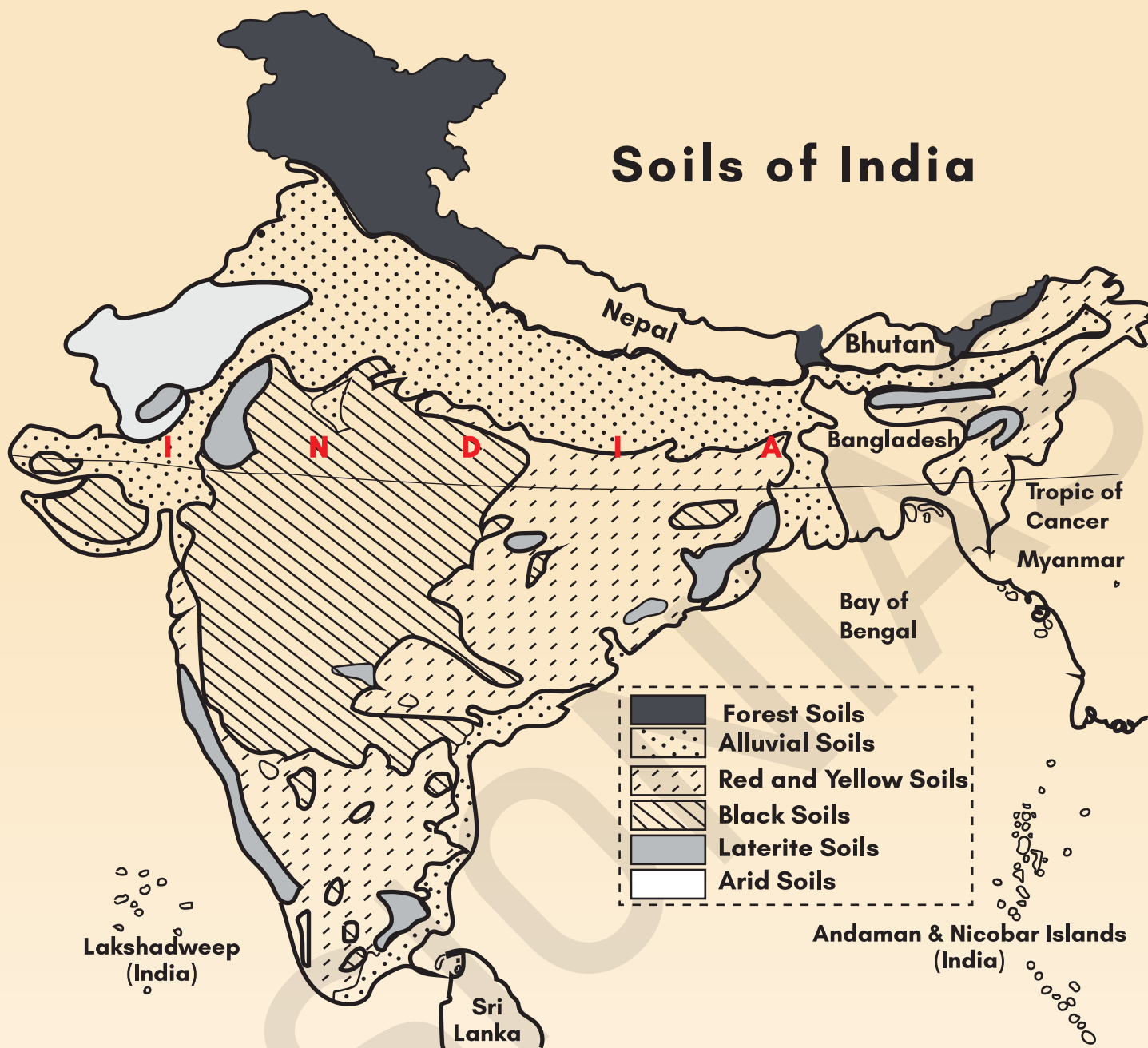




	<p>plains of Gujarat. In the Peninsular region, they are found in deltas of the east coast and in the river valleys.</p> <ul style="list-style-type: none">• These soils are loamier and more clayey in the lower and middle Ganga plain and the Brahmaputra valley.• The sand content decreases from the west to east.• They are generally rich in potash but poor in phosphorous. Alluvial soils are intensively cultivated.
Regur Soil/ Black Soil	<ul style="list-style-type: none">• Formed from the volcanic lava. On account of high iron content and humus it is of black colour.• It covers most of the Deccan Plateau. In the upper reaches of the Godavari and the Krishna, and the north western part of the Deccan Plateau, the black soil is very deep.• These soils are known for their 'self ploughing' nature.• The black soils are generally clayey, deep and impermeable. They swell and become sticky when wet and shrink when dried.• During the dry season, these soils develop wide cracks.• Retains the moisture for a very long time, which helps the crops, especially, the rain fed ones, to sustain even during the dry season.
Red and Yellow Soil	<ul style="list-style-type: none">• It is formed from weathering of crystalline granite (igneous rocks) and gneiss (metamorphic 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.• 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 hydrated form.• They are generally rich in minerals like Iron, lime and potash but poor in nitrogen, phosphorous and humus.
Laterite Soil	<ul style="list-style-type: none">• Formed under specific monsoon conditions of climate. Under such conditions, leaching of soils is accelerated.• This process reduces the silica content of rocks in soils leaving the soil rich in iron and aluminium content.• Humus content of the soil is removed fast by bacteria that thrive well in high temperature.• These soils are poor in organic matter, nitrogen, phosphate and calcium, while iron oxide and potash are in excess.• Not suitable for cultivation; however, application of manures

	<p>and fertilizers are required for making the soils fertile for cultivation.</p> <ul style="list-style-type: none"> ● Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for tree crops like cashew. ● Laterite soils are widely cut as bricks for use in house construction.
Saline Soil or Usara Soil	<ul style="list-style-type: none"> ● Contains a larger proportion of sodium, potassium and magnesium, and thus, they are infertile, and do not support any vegetative growth. ● They have more salts, largely because of dry climate and poor drainage. ● Lack in nitrogen and calcium. ● Found in arid and semi-arid regions, western Gujarat, deltas of the eastern coast and in Sunderban areas of West Bengal. ● In 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	<ul style="list-style-type: none"> ● Found in areas of heavy rainfall and high humidity such as Kerala, Odisha, Bengal, Coastal areas of Tamil Nadu. ● Large quantity of dead organic matter accumulates in these areas, and this gives a rich humus and organic content to the soil. ● The vegetation grows very dense in these areas. At many places, they are alkaline also due to presence of salt.
Forest Soil	<ul style="list-style-type: none"> ● Formed in the mountain ranges of Himalayas, Purvanchal, Sahaydri etc. where sufficient rainfall is available. ● Soil is loamy and silty on valley sides and coarse grained in the upper slopes. ● The lower valleys soil is fertile. On steep slopes, soil is very thin and less productive.
Arid Soil	<ul style="list-style-type: none"> ● In the deserts, accelerated weathering of rocks take place on account of heating during day and cooling during night. ● In this type of soil mainly sand grains are found with little or no humus. ● Has less capacity to hold moisture. Its colour varies from red to brown. ● Nitrogen is insufficient and the phosphate content is normal. ● Developed in western Rajasthan and semi-arid type in southern Punjab and Haryana.

Soils of India



Soil acidity is a property related to the proportion of exchangeable hydrogen in the soil in relation to other elements. A pH value of about 6.5 is normally regarded as the most favourable for the growth of cereal crops.

Soil Degradation

- Soil degradation is defined as the decline in the soil quality or the soil fertility.
- The degree of soil degradation varies from region to region according to the topography, wind, precipitation and anthropogenic factors.
- Soil degradation includes soil erosion, physical deterioration, chemical deterioration and biological deterioration.





Types of Soil Degradation

Soil degradation can be classified into two main types of degradation, water erosion and wind erosion.

Water Erosion

Water erosion means that soil particles are detached either by splash erosion (caused by raindrops), or by the effect of running water. Water erosion is influenced by four factors: rainfall, soil type, slope gradient, and soil use/vegetation cover.



Types of Water Erosion

Sheet Erosion:

- This means when a fairly uniform layer of soil is removed over an entire surface area.



Rill Erosion:

- This occurs where water runs in very small channels over the soil surface, with the abrading effect of transported soil particles causing deeper incision of the channels into the surface.



Gully Erosion:

- This type of erosion occurs when rills flow together to make larger streams. They tend to become deeper with successive flows of water and can become major obstacles to cultivation.



Bank Erosion:

- This is caused by water cutting into the banks of streams and rivers. It can be very serious at times of large floods and cause major destruction to property.



Wind Erosion

- Wind is a common cause of land degradation in the arid and semi arid grazing lands .
- It is one of the processes leading to desertification.
- Also referred to as eolian erosion.
- Significant wind erosion occurs when strong winds blow over light-textured soils that have been heavily grazed during periods of drought.



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DELHI



LUCKNOW



JAIPUR



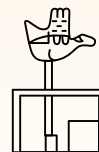
HYDERABAD



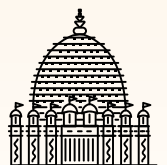
PUNE



AHMEDABAD



CHANDIGARH



GUWAHATI