

SOIL RESOURCES

Soil forms the topmost layer of the Earth's land surface. It is the thin layer of loose mixture of small rock particles and rotting a matter that covers much of the land.

Constituents of Soil:

Soils are derived from parent rock material through a process of breakup or wear and tear.

Soil Fertility:

Soil fertility refers to the strength of the soil to support plant life. Fertile soil has the following characteristics:

- (i) It contains adequate amount of moisture to supply essential nutrients to the plants.
- (ii) It has sufficient depth to enable the plants to grow their roots as per their requirements.
- (iii) It is rich in nutrients such as nitrogen, phosphorus and potassium.
- (iv) It contains organic matter that improves the structure of soil.

Soil Classification:

According to its location, soil can be classified as:

(i) Residual or Sedimentary Soil: Almost all soils are formed 'in situ', that is, they are formed in their original position by the breaking up of parent rocks. They include black soil, red soil, laterite soil, desert soil, etc.

(ii) Transported Soil: These soils are ex situ, that is, transported by various agents of erosion and consist of sediments carried and deposited by rivers and winds.

TYPES OF SOILS:

The soils of India are classified on the basis of their origin and formation as follows:

1. ALLUVIAL SOILS:

These soils are formed by the sediments brought down by rivers. They are

also rich in chemical ingredients. The rivers deposit very fine particles of soil called alluvium in their plains during the course of their long journey.

Alluvial soil is also known as riverine soil because it is mainly found in the river basins. It is a mixture of sand, clay and silt, called loam.

These have been deposited by three important river systems-the Indus, the Ganga and the Brahmaputra. These soils occupy 40 per cent of the land area. The entire Northern Plains are made up of these soils. These soils are also predominant in coastal plains and deltas particularly in the deltas of the Mahanadi, the Godavari, the Krishna and the Kaveri rivers.

On the basis of its age, the alluvial soil is of two types-bhangar and khadar

The bhangra or the older alluvium is composed of lime nodules or kanker and has a clayey composition. The khadar is light in colour and is composed of newer deposits.

Khadar is more fertile than bhangar soil as new layers are deposited year after year during monsoon floods.



Crops can be grown on old alluvial soils by using manure. They form the largest and most important group as they contribute the largest share to the agricultural wealth of India.

Distribution:

I. Inland Alluvium:

These soils are found on the plains of the Indus, the Ganga and the Brahmaputra rivers. Punjab, Haryana, Uttarakhand, Uttar Pradesh, Bihar, West Bengal have alluvial soils.

II. Deltaic Alluvium:

The Deltaic alluvium is found in the deltas of the Ganga-Brahmaputra, Mahanadi, Godavari, Krishna and Kaveri rivers.

III. Coastal Alluvium:

It is of tidal origin. It is found in the coastal strips of Peninsular India. It is also found in the plains of Gujarat.

Characteristics of Alluvial Soil:

(i) It is formed by the deposition of the river load as it flows from its upper to its lower course.

(ii) The soil is coarse. Soil particles are large and non uniform. Such soil is predominant in piedmont plains (plains near the foot of mountains).

(iii) The alluvial soil of the Upper Ganga Valley is dry, porous, sandy, faint yellow and consists of clay and organic matter, while the soil of lower Ganga Valley, ie., of West Bengal and Bangladesh is more compact, less coarse and more moist.

(iv) It is light and porous, therefore easily tillable.

(v) It is a fertile soil and it is rich in minerals, especially potash and lime.

(vi) It is deficient in nitrogen and humus, except the alluvium of the Ganga deltaic region which is rich in humus.

(vii) It is suitable for the growth of a large variety of rabi and kharif crops.

Crops:

Alluvial soil is fertile and suitable for cultivation of rice, wheat, sugarcane, cotton, tobacco, gram and oilseeds. In the lower Ganga-Brahmaputra Valley it is useful for jute cultivation.

2. BLACK SOIL:

This soil is black in colour and is also known as the **Regur soil or Black Cotton Soil**. It is dark in colour and is suitable for cotton cultivation. This soil is the residual soil, i.e., it is formed at the place of its origin over the underlying rocks. Since it is formed by the denudation of volcanic rocks, it is also known as lava soil.

Distribution: Maharashtra, Gujarat.

Characteristics of Regur (Black) Soil:-

- (i) It is **fine** textured and clayey in nature.
- (ii) It has high quantities of lime, iron, magnesium and generally poor percentage of phosphorous, nitrogen and organic matter.
- (iii) It is **black** in colour as it is formed from weathered lava rocks.
- (iv) It is **very clayey** and, therefore, highly retentive of water. Because of high clay content, this soil expands when wet and become difficult to plough, During the dry season, black soil shrinks and develops big cracks which help in air circulation.
- (v) The soil is very fertile in most of the places.

(vi) It is suitable for cultivation of cotton, jowar, wheat, sugarcane, linseed and gram.

(vii) In any season it has moisture stored in its subsoil.

Crops

The moisture retentiveness of black soil makes it suitable for dry farming.

3. RED SOIL:

Under prolonged weathering by rainfall, ancient crystalline and metamorphic rocks of the Peninsular plateau break up to form this soil. This soil differs from place to place on the basis of the parental rock material and climatic conditions. It is red in colour as it contains large amounts of iron oxide. At several places, its colour slightly changes and it appears brown or grey. It looks yellow when it occurs in a hydrated form.

Distribution: Tamil Nadu in the south to Bundelkhand in the north and Rajmahal Hills in the east to Kutch in the west.

Characteristics of Red Soil:

- (i) Red soil has got its name from its colour.
- (ii) It is porous and has high percentage of iron oxide.
- (iii) It is generally shallow and its pH value ranges from 6.6 to 8.0.
- (iv) It is loose and aerated.
- (v) It is poor in nitrogen, phosphorus, potassium and organic matter.
- (vi) It is ideal for dry farming as it is formed in poor rainfall areas.
- (vii) It is not fertile but responds to fertilizers.
- (viii) It needs irrigation support for cultivation.

Crops

Though red soil is suitable for cultivating almost all crop types, it is **most suitable for growing vegetables, rice, ragi and tobacco.**

Groundnut and potatoes can be grown on coarse soils at higher levels and sugarcane on heavy clays at lower levels.

4. LATERITE SOIL:

This soil type is formed as a result of atmospheric weathering of rocks under conditions of high rainfall and temperature with alternate wet and dry periods. It is the residual soil formed by leaching due to tropical rains.

Leaching is the process in which the nutrients get percolated down below the soil due to heavy rainfall; thus leaving the top soil infertile. This is also called **desilication**. Due to heavy rains, lime and silica are leached away and aluminium compounds are left behind. Humus content of the soil is removed by bacteria that survives well in high temperature.

There are two types of laterite soils: Upland Laterites and Lowland Laterites. **Upland laterites** are formed over hills and uplands. From there they are transported by streams towards lowlands. Such transported soils are known as **Lowland Laterites.**

Distribution: Western & Eastern Ghats

Characteristics of Laterite Soil:

(i) It is of a coarse texture, soft and friable.

(ii) It is red due to the presence of iron oxide which is formed by leaching. The soluble plant foods like potash are removed from the top soil leaving alumina and iron oxide.

(iii) It is a porous soil; silica is removed from it by chemical action. It is poor in lime and magnesium and deficient in nitrogen.

It is suitable for construction material.

(iv) It does not retain moisture and hence is not fertile. It suits only special crops like tapioca, cashewnuts, tea, coffee, etc.

(v) It is acidic in nature as alkalis are leached.

(vi) It is considered suitable for building purposes.

Crops:

As the laterite soil has low fertility because of high acidity and low moisture retention, manuring and other activities are required to make it suitable for growing crops such as ragi, rice and sugarcane. Paddy is grown on lower elevations, whereas tea, cinchona, rubber and coffee are grown on higher elevations.

SOIL EROSION

The removal of the top soil cover by water, wind and human activities is called soil erosion.

1. SOIL EROSION BY WATER:-

(i) Sheet Erosion: It occurs on gentle slopes and is the slow removal of a thin layer of soil when vegetation is destroyed. Rainwater washes away the thin layer of bare soils.



(ii) Rill Erosion: When sheet erosion continues for long, the silt-laden run-off forms many finger-shaped rills or grooves over a large area. This is called rill erosion it is the intermediate stage between sheet erosion and gully erosion.



(iii) **Gully Erosion**: During heavy downpour, deep gullies are made on bare soils on account of water run-off. Gully erosion removes nutrients and heavy load of loose soils, making the soil unproductive. It makes water very muddy. This is seen in the Chambal Valley region

(iv) **Leaching**: After harvesting, farmers leave the soils bare for some time. During rainfall the nutrients in the soil are leached or percolated below the top layer.

(v) **Sea or Shore Erosion**: The tidal waters of the sea cause considerable damage to the soil along the coast. The powerful waves dash against the coast and break hanging cliff rocks. The broken material is then removed by the retreating sea waves.

(vi) **Stream Bank Erosion**: Streams and rivers change their courses by cutting one bank and depositing the silt loads on the other. During flash floods, the damage is accelerated.

2. SOIL EROSION DUE TO HUMAN ACTION

(i) The loss of vegetation cover leads to Sheet Erosion on hilly slopes because water instead of sinking into the ground washes the soil down.

In the second stage, in the absence of vegetation cover and washing off of the absorbent top soil, rills begin to appear on the landscape.

In the third stage, the water run off during heavy rains may develop deep grooves causing Gully Erosion.

(ii) Local population practise shifting cultivation. The heavy rains then wash away the bare soil from the slopes to the valleys below.

(iii) Another important cause of Sheet, Rill and Gully Erosion is uncontrolled grazing of domestic animals in the valleys and the upper slopes.

3. **EROSION BY WIND**

Wind Erosion refers to the movement and deposition of soil particles by wind. It occurs when soil devoid of vegetation is exposed to high-velocity wind.

Wind moves soil particles 0.1-0.5mm in size in bouncing or hopping fashion is known as **saltation** and those greater than 0.5 mm by rolling is known as **soil creep**. The particles less than 0.1 mm or the finest particles detach into suspension.

Causes of Soil Erosion:

(i) Heavy Population Pressure on Land: India's forest cover continues to be very low, **just *21.54 per cent** of the total area.

(ii) Nature of Rainfall: India receives 80 to 90 per cent of rainfall in the monsoon season. Heavy downpour during monsoon months causes floods. In the remaining months droughts are frequent. This affects the soils.

(iii) Overgrazing: The number of domestic animals particularly the cattle in India is the highest in the world. The cattle freely graze in open lands making them bare of vegetation. Winds carry away dry soil particles from the bare landscape.

(iv) Bad Farming Techniques: The poor farmers plough fields in traditional ways. The farming techniques and small size of holdings lead to soil erosion on a large scale.

The absence of terracing, contour cultivation, crop rotation and the improper use of manure etc., have caused serious problems of soil erosion.

(v) **Topography:** Northeastern parts of India, Shiwaliks and hilly regions in South India are affected by soil erosion because of steep slopes and heavy rainfall. During heavy rainfall, soils are washed away by running water down the slope.

(vi) **Deforestation:** Forests are destroyed so that more land can be used for cultivation. Cutting of trees exposes the soil to water and wind, which leads to soil erosion.

REGIONS OF SOIL EROSION:

Rajasthan comes on the top of the soil eroded regions, followed by Madhya Pradesh, Maharashtra, Uttar Pradesh, Gujarat, Andhra Pradesh and Karnataka. The worst affected areas include:

- (i) the badlands of the Chambal and Yamuna rivers;
- (ii) the piedmont zone of the western Himalayas,
- (iii) the Chotanagpur plateau region;
- (iv) the Tapi-Sabarmati valley region in Gujarat; soil area of Maharashtra; and
- (v) the dry areas of Rajasthan, Gujarat and Haryana..



PREVENTION

1. **Terrace Farming:** On hilly slopes, terraces act as bunds and prevent the soil from being washed away by running water.

Terrace farming is with successful results in Japan South-East Asia and the USA.

2. **Shelter Belts:** Farmers plant trees in several rows to check wind erosion. They are known as wind breaks.

3. **Contour Ploughing**: Ploughing along contours on a slope prevents soil being washed away by rainwater or by surface run off. Contours act like bunds. Terraces are levelled into step-like small fields with even slope. Contour ploughing is common in Japan, China and some South-East Asian countries.
4. **Strip Cropping**: Crops are grown in alternate strips of land to check the impact of the winds.
5. **Construction of Dams**: Rivers cause soil erosion. Dams are built in the upper course of rivers to control erosion of soil.
6. **Plugging Gullies**: The gullies made in the soil are plugged with deposition of silt during heavy rains.
7. **Planting Trees**: The trees, like in the case of Shelter Belts, are planted along the edges of the fields the waste land and on steep slopes to prevent soil erosion as well as to enhance the capacity of the soil to retain water.

SOIL CONSERVATION

Soil conservation means prevention of soil loss from erosion or prevention of reduced fertility of soil caused by over usage, acidification, salinisation or other types of soil contamination.

SOIL CONSERVATION SCHEMES

(i) The centrally sponsored scheme of Integrated Watershed Management in the catchments of flood-prone rivers aims at enhancing the ability of the catchment, reducing erosion and consequent silt load.

(ii) A scheme for reclamation and development of ravine areas was launched in Madhya Pradesh, Uttar Pradesh and Rajasthan.

(iii) The scheme for control of shifting cultivation is being implemented in the north eastern States. It encourages farmers to practise terraced cultivation and afforestation to support fuel and fodder requirements.

(iv) National Project on Development and Use of Bio-Fertilizers and National Project on Quality Control encourage the use of bio-fertilizers as well as balanced and integrated use of fertilizers.

(v) In urban areas, rainwater harvesting is a means of checking soil erosion, besides recharging ground water.

