SOILS OF INDIA

Soil is the topmost layer of the earth's surface. Soil is one of the most important natural resources as it is indispensable for the existence of plants and animals. It consists of a mixture of minute particles of disintegrated rocks, minerals, organic matter and bacteria. Soil is formed when forces of nature such as temperature, rain, wind, waves, animals and plants act on rocks and break them into tiny pieces over a long period of time. The depth of soil is not the same in all parts of the country. Soil may be only a few centimeters deep in some places while in others it may extend to as much as 30 meters generally.

Soil consists of four layers. The first or topmost layer of soil is made up of minute soil particles and decayed plant and animal matter. This layer is vital for the cultivation of crops. The second layer is made up of fine particles like clay; the third layer is a combination of weathered basic rock materials and soil while the fourth layer consists of un-weathered hard rocks.

Soils of India and its General Characteristics

India has various types of soil ranging from the fertile alluvial of the Indo-Gangetic plains to the black and red soils of the Deccan Plateau. Each type of soil benefits different types of crops through their unique physical, chemical and biological properties.

Soils of India are classified based on their colour, structure and place where they are found. The Indian Agricultural Research Institute has divided the soils of the country into 27 types according to their colour, texture, and retentive capacity of moisture. However, they may be grouped into the following 11 categories.

- **Alluvial Soils:** Alluvial soils are widespread. They occur throughout the Indo-Gangetic Plain and along the lower courses of virtually all the country's major rivers (especially the deltas along the east coast). The non-deltaic plains along India's coasts are also marked by narrow ribbons of alluvium. The soil is fine grained and is formed of sediments brought down by rivers. New alluvium found on much of the Indo-Gangetic floodplain is called Khadar and is extremely fertile and uniform in texture; conversely, the old alluvium on the slightly elevated terraces, termed Bhangar, carries patches of alkaline efflorescences, called usar, rendering some areas infertile. In the Ganges basin, sandy aquifers holding an enormous reserve of groundwater ensure irrigation and help make the plain the most agriculturally productive region of the country. Alluvial soil is very productive; wheat, sugarcane, oilseeds, pulses, rice and jute are grown on this soil.
- **Black Soils:** They are common in the Deccan Trap region covering Maharastra, and parts of Gujrat, Madhya Pradesh, Andhra Pradesh and Karnataka. Black soil is rich in chemical properties and very suitable for the growth of cotton, jowar, wheat, linseed, groundnut and gram. They are known as Black Cotton Soils. It is also known as Deccan Trap Soil or Regur.. Locally, they are known as Regur Soils. They are made up of volcanic rocks or lava flows. These soils are clayey and contain mineral substances. They retain moisture for a long period. These soils are fertile and suitable for cotton, sugarcane, wheat and grondnut.
- **Red Soils:** Very large parts of the peninsular India, particularly in the states of Tamil Nadu, Andhra Pradesh, Karnataka and Orissa are covered with red soils. In the north, it extends into some districts of West Bengal and Uttar Pradesh and it also covers the eastern half of the Rajasthan. These soils have a mixture of sand and clay. They are red in colour as they contain a great proportion of iron oxides. They

are deficient in nitrogen, phosphoric acid and humus, but are rich in potash and lime. They are relatively less fertile, but are capable of growing good crops with the help of irrigation and fertilizers. Rice, wheat, millet, gram, pulses, sugarcane, oilseeds and cotton are cultivated on these soils.

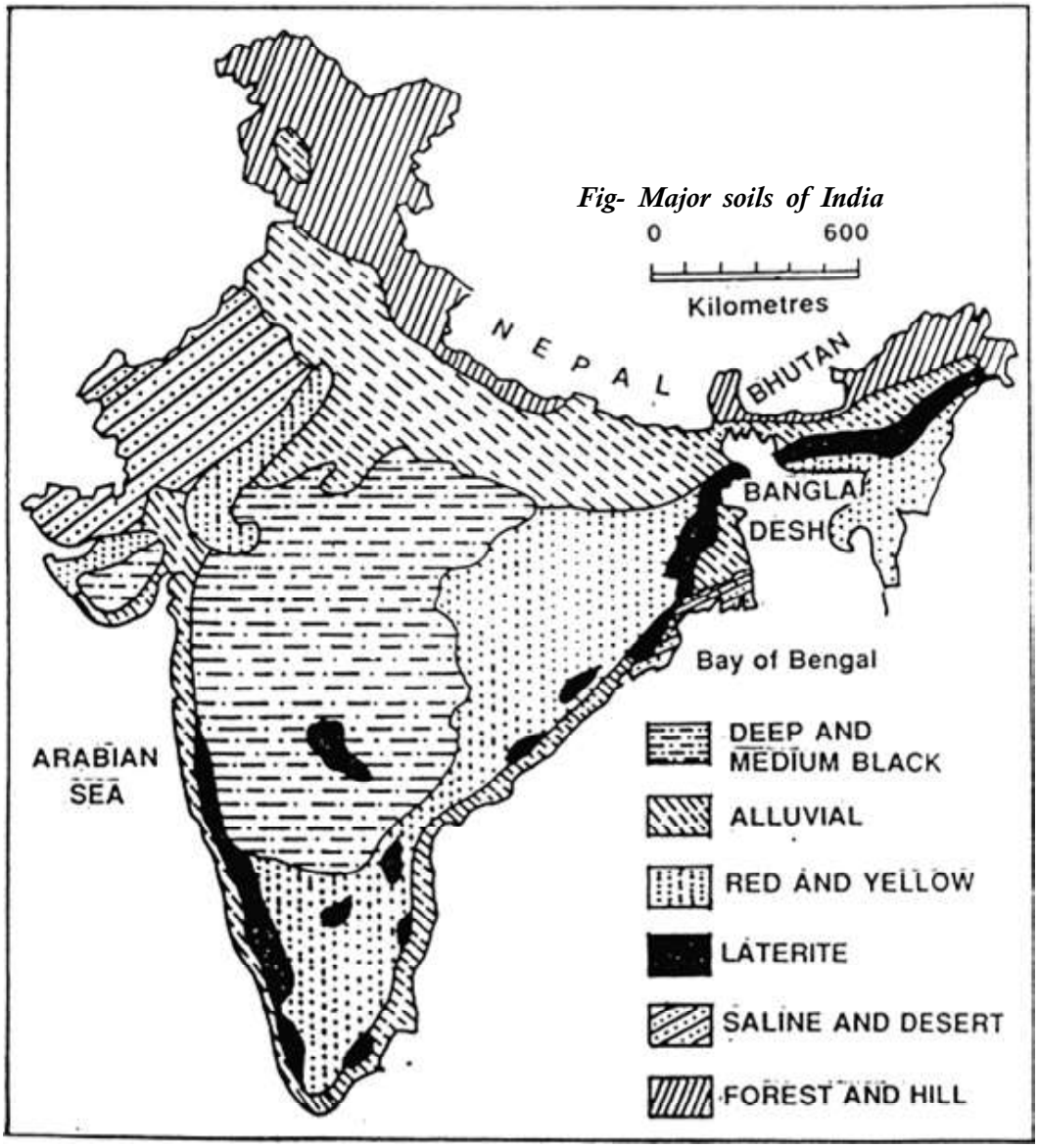

Fig- Major soils of India

- **Laterite Soils:** These soils are found in patches of Western Ghats and parts of Chhotanagpur, Karnataka and Tamil Nadu.The word 'late rite' comes from a Latin word 'Later' which means brick; in fact, these soils look like dust of red bricks. They are red in colour. They are rich in iron, but deficient in lime and nitrogen. These soils are infertile, as they cannot hold moisture.
- **Coastal Alluvial Soils:** These soils are found along the east and west coast of India. These soils are sandy than clayey. They are saline in nature. Rice and coconut are grown abundantly on these soils.
- **Deltaic Soils:** These soils are found on the deltas of the Ganga, Mahanadi, Godavari, Krishna and Kaveri of the east coast and in parts of Rann of Katchch on the west coast. These muddy soils are saline in nature due to influence of ocean water. Agriculture is not suitable on these soils as they are too much saline. However, in some areas where salinity of the soil is reduced by protecting the land from saline tidewater by building up dams, agriculture can successfully be carried on. Rice, maize and other crops are grown on it.
- **Desert Soils:** These soils are found in Rajasthan deserts; the southern parts of the Punjab and Rann of Katchch.These soils contain coarse brown sands and are very porous. These soils are not suitable for agriculture due to scanty rainfall; however, agriculture can be carried on with the help of irrigation. Bajra, wheat, groundnut can be grown on these soils.

- **Terai Soils:** These soils are found on the foothill regions of the Himalayas in India. These soils are composed of gravels and coarse grained sand. They are popularly known as 'bhabar'. Recently the forest has been cleared for cultivation and rice, sugarcane, soybean, etc. aregrown.
- **Mountain Forest Soils:** These soils are found on the Himalayan Mountain. These soils are made of rock, boulders and clay. They are infertile and suitable for cultivation of potatoes, rice, wheat, fruits.
- **Alpine Grassland Soils:** These soils are found on higher altitudes of the Himalayas where alpine grasses grow. These soils are acidic and are of medium fertility. On these soils barley, maize, potatoes and wheat are grown.
- **Glacial Soils:** These soils are found on high altitudes of the Himalayas. They contain glacial deposits, boulders, gravels and clay. Generally, there is no cultivation on it. On some few patches, barlay and potatoes are grown.

Soil Erosion and Conservation

Soil Erosion

Soil erosion in India is a major cause of concern. Almost 130 million hectares of land i.e. approx 45% of total land is affected by serious soil erosion through gorge and gully, shifting cultivation, water logging, etc.

Soil erosion is the gradual removal of the top soil cover by natural agencies like water, wind, etc or by manmade activities as alkanisation, salinization of soil, deforestation, etc.

Soil erosion is almost universally reorganized as a serious threat to man's well-being. The two main agents of erosion are wind and water. In the case of erosion by water, the major erosive agents are impacting raindrops and run-off water flowing over the soil surface. Erosion and sedimentation embody the processes of detachment, transportation and deposition of soil particles. Detachments are the dislodging of soil particles from the soil mass by erosive agents.

Most of the land area in the country shows evidence of degradation thus affecting the productive base of economy. Out of the total geographical area of 329 million hectares, 175 million hectares are considered degraded.

Although soil-erosion is frequent throughout the country, it operates most intensely in the hilly regions. The precipitation often occurs in torrents which instead of sinking into the ground as the light drizzles, wash away the top layers of the soil. The steep slopes of the hills further stimulate the eroding power of the rain water. The soils are very thin and all exposed slopes are susceptible to serious sheet erosion or gullying.

Erosion may be of little consequence for hilly tracts, but is of great significance to the plains. The whole basin of Kosi river is threatened by this erosion, as a result of which the rivers bring with them millions of tonnes of sand and debris annually. When the rivers reach the plains and below and the stream flow slackens, the load is dropped and gets deposited in their beds. This leads to choking of river channels, which in turn increase the flood danger and induces shifting of the course which brings disaster.

Both surface erosion and deep gullying are considerably influenced by the type of soil in India, although a given soil type may not behave consistently under all conditions and no type of soil is entirely safe from erosion. Thus, sandy porous soil in the country are in general least subject to gradual weathering down by water action, since they are capable of absorbing a great amount of water in ordinary rains. On the other hand, if the rate

of percolation is prevented by frost or by even thin strata of clay, the very lack of "binding" qualities in the sandy soils permit them to be moved at a very rapid pace. Again, however, the coarseness of the material may cause it to be deposited before it has been carried to any great distance.

The most potent and common causes for erosion in India are deforestation and overgrazing. Throughout the country, as population has increased, more and more forests have been destroyed mainly by grazing cattle feeding on grass and herbs and green bushes.

Effects of soil erosion

a) Loss of fertile top soil leading to gradual loss of soil fertility and agricultural productivity.

b) Loss of mineral nutrients from soil through leaching and flooding.

c) Lowering of the underground water table and decrease in the percentage of soil moisture.

d) Drying of vegetation and extension of arid lands.

e) Increase in frequency of droughts and floods.

f) Silting of river and canal belts.

g) Recurrence of landslides.

h) Adverse effect on economic prosperity and cultural development.

Soil conservation

Soil conservation is maintaining good soil health, by various practices. The aim of soil conservation methods is to prevent soil erosion, prevent soil's overuse and prevent soil contamination from chemicals. There are various measures that are used to maintain soil health, and prevent the above harms to soil. Here are the soil conservation methods which are practiced for soil management.

a) Planting Vegetation: This is one of the most effective and cost saving soil conservation methods. By planting trees, grass, plants, soil erosion can be greatly prevented. Plants help to stabilize the properties of soil and trees also act as a wind barrier and prevent soil from being blown away.

This is also among strategies used for soil conservation methods in urban areas, one can plant trees and plants in the landscape areas of the residential places. The best choices for vegetation are herbs, small trees, plants with wild flowers, and creepers which provide a ground cover.

b) Contour Ploughing: Contour farming or ploughing is used by farmers, wherein they plough across a slope and follow the elevation contour lines. This method prevents water runoff, and thus prevents soil erosion by allowing water to slowly penetrate the soil.

c) Maintaining the Soil pH: The measurement of soil's acidity or alkalinity is done by measuring the soil pH levels. Soil gets polluted due to the addition of basic or acidic pollutants which can be countered by maintaining the desirable pH of soil.

d) Soil Organisms: Without the activities performed by soil organisms, the organic material required by plants will litter and won't be available for plant growth. Using beneficial soil organisms like earthworms, helps in aeration of soil and makes the macro-nutrients available for the plants. Thus, the soil becomes more fertile and porous.

e) **Crop Rotation Practice:** Crop rotation is the soil conservation method where a series of different crops are planted one after the other in the same soil area, and is used greatly in organic farming. This is done to prevent the accumulation of pathogens, which occur if the same plants are grown in the soil, and also gap depletion of nutrients.

f) **Watering the Soil:** We water plants and trees, but it is equally important to water soil to maintain its health. Soil erosion occurs if the soil is blown away by wind. By watering and settling the soil, one can prevent soil erosion from the blowing away of soil by wind. One of the effective soil conservation methods in India is the drip irrigation system which provides water to the soil without the water running off.

g) **Salinity Management:** Excessive collection of salts in the soil has harmful effects on the metabolism of plants. Salinity can lead to death of the vegetation and thus cause soil erosion, which is why salinity management is important.

h) **Terracing:** Terracing is among one of the best soil conservation methods, where cultivation is done on a terrace leveled section of land. In terracing, farming is done on a unique step like structure and the possibility of water running off is slowed down.

i) **Bordering from Indigenous Crops:** It is preferable to plant native plants, but when native plants are not planted then bordering the crops with indigenous crops is necessary. This helps to prevent soil erosion, and this measure is greatly opted in poor rural areas.

j) **No-tilling Farming Method:** The process of soil being ploughed for farming is called tilling, wherein the fertilizers get mixed and the rows for plantation are created. However, this method leads to death of beneficial soil organisms, loss of organic matter and compaction of soil. Due to these side effects, the no-tilling strategy is used to conserve soil health.

k) **Increased use of organic manure:** Through manuring, the Indian farmers can check the deflection of soil nutrients, which takes place with continuous cropping. Manures can be animal and plant residues. They ensure yet another aspect of soil conservation viz, the building up of soil productivity.

l) **Keeping the soil covered:** Grasses are even more firm protectors of soil than the trees.

m) **River embankments:** By making river embankments, soil erosion can be reduced along the bank of the rivers.