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ICSE GEOGRAPHY

Based on the latest ICSE syllabus

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ICSE GEOGRAPHY

Class 10

Chapter 7: India – Soil Resources

FORMATION OF SOIL

Regolith: The layer of broken rocks on Earth's surface is called regolith. This layer of broken rock pieces develops into soil by the work of various chemical, mechanical and biological processes.
The process of soil formation is very slow as it may take about 600 – 1000 years to form 2.5 cm thick layer of soil. The general thickness of soil's layer on the Earth's surface varies between one and three metres.

The process of soil formation is mainly related to underlying parent rock material, relief features (especially the elevation and nature of slope), climatic condition, plant and animal organisms and human activities. The plants and microorganisms help in converting the young soil into mature soil. The dark brown colour of the soil is due to humus, which is provided by the dead plants on decomposition. The chemical composition of the soil depends upon the parent rock material.

The soils that are formed due to prolonged weathering of rock and the broken rock materials do not move away or are not transported by any agent are called the residual soils or 'in situ'.

In some cases, the agents of denudation, such as wind, running water or glacier, transport the weathered or broken rocks to other places. These transported sediments are deposited in river valleys or flood plains to form the transported soils that include the alluvial soils.

COMPOSITION OF SOIL

Almost all types of soils have developed from rocks and have four basic elements, such as:

1. Inorganic materials (derived from parent rocks).
2. Organic materials (formed due to the decomposition of plant remains, animal manure and dead animals).
3. Water
4. Air

The fine rock and other particles in the soil contain in varying proportions silica, clay, chalk and humus. The organic components determine the fertility of soil.

The inorganic elements in the soil include mineral salts, such as nitrogen, potassium, phosphorus, magnesium, calcium, iron and sulphur. The significance of inorganic elements is as follows:

1. Nitrogen is essential for plant growth and reproduction.
2. Potassium provides starch to the plants and improves the quality of seeds.
3. Phosphorus helps in increasing plant growth and also the yields of crops.
4. Magnesium and calcium help in the growth of leaves.
5. Iron and sulphur contribute to plant growth and development.

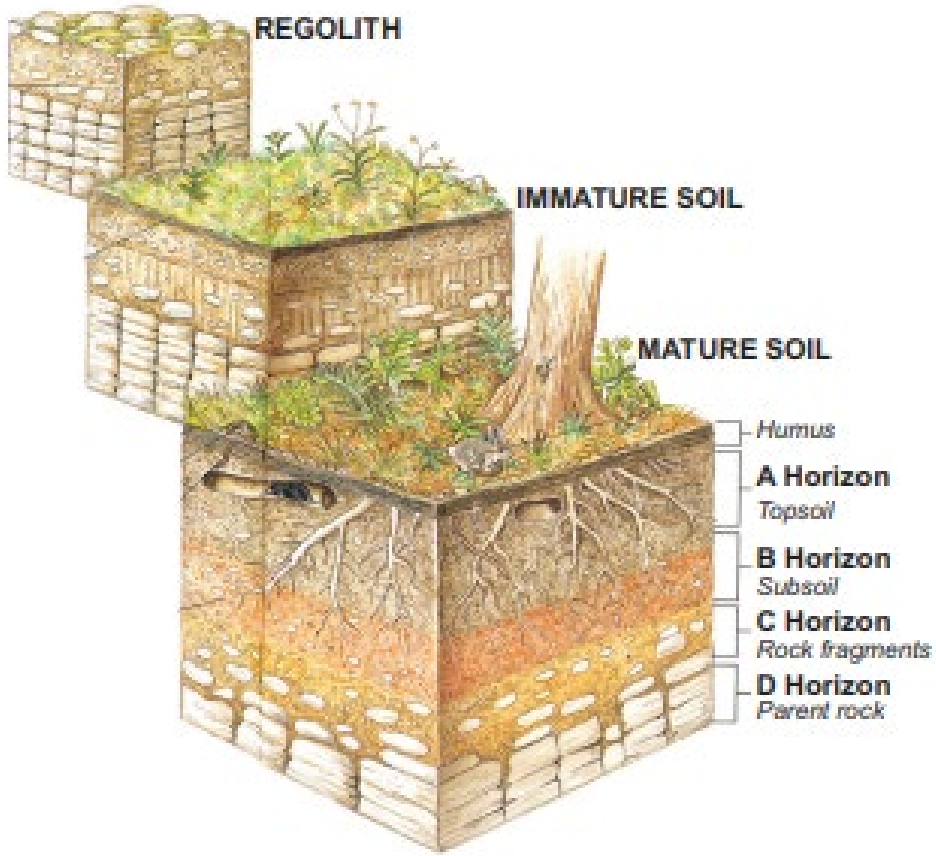
SOIL PROFILE

The process of soil formation gives rise to well-developed horizontal layers in the soil profile. These layers are also called soil horizons. The soil horizons are marked as A, B, C and D from the uppermost layer of the soil to the parent rock below.

Horizon A (topsoil) is the topmost layer and has soluble minerals and organic material (humus) from decayed plants and animals. These are needed for the growth of plants. In this layer, leaching of soil is common.

Horizon B (subsoil) is just below the topsoil in which sand, silt and clay are found. This layer has more mineral content than Horizon A, but has limited organic matter. Horizon A and B together form the real soil.

Horizon C (rock fragments) has small pieces of rocks, which are not affected by the biological processes. The true soil develops from these rock materials.



Soil profile

Horizon D (parent rock) is just below Horizon C and has unbroken solid rock materials.

CHARACTERISTICS OF SOIL

The main characteristics of the soil are its colour, texture and structure. The soils can be yellow, red, brown, grey or black in colour.

- Yellow or grey colour of the soil can be due to leaching.
- The red soils are rich in iron contents, while the black soils have high organic content.

We cannot understand the nature or usefulness of soil from its colour only. The size of rock or dust particles, which may vary from gravel, sand, silt to fine clay in the soil, defines the texture of the soil.

The loamy soils have a mixture of sand, silt and clay. The structure of the soil refers to the manner in which the soil particles are arranged or grouped. Soils with well-developed structure do not get eroded easily.

TYPES OF SOILS IN INDIA

India is a big country with varied conditions of relief features, and different composition of rocks, climatic conditions and natural vegetation. Thus, the soils in India vary from place to place and also differ in colour, composition, texture, structure and fertility.

In ancient India, the soils were classified on the basis of their fertility, i.e., urvara (fertile) and usara (sterile). Today the soils in India can be classified on the basis of:

1. colour: yellow, red, brown, black, etc.
2. texture: sandy, clayey, loamy, etc.
3. formation: residual or transported.

The committee appointed by the Indian Council of Agricultural Research (ICAR) classified the Indian soils into alluvial, black, red, laterite, mountain and desert soils.

Alluvial Soils

The alluvial soils are the most important type of soils in India. These soils cover about 45 per cent of the total land area of the country. These soils are very fertile and support the bulk of India's population.

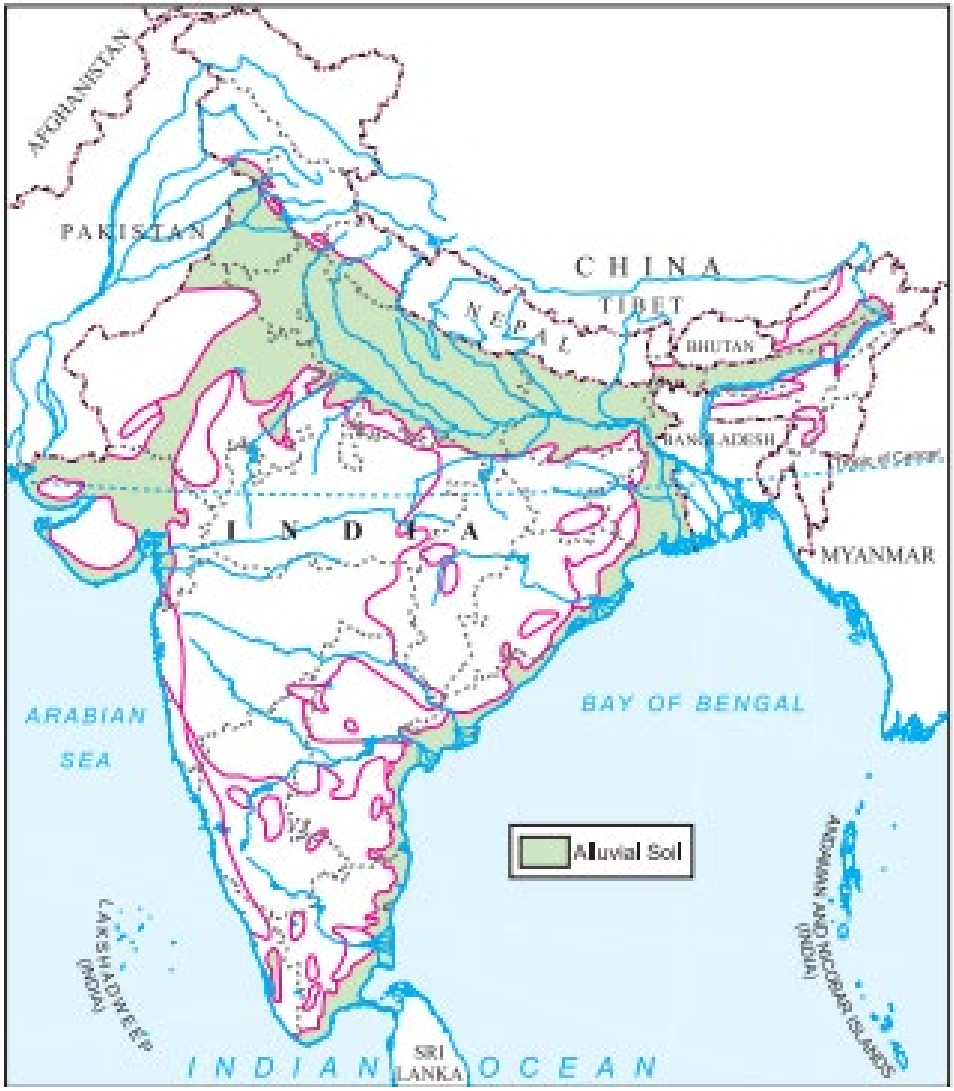
India – Major types of soils

Loam or alluvium: The rivers that originate from the Himalayan mountains bring with them a large amount of sediments. These sediments are deposited in the river valleys and in the flood plains. These sediments are composed of fine particles of sand, silt and clay. These are called loam or alluvium.

The alluvial soils are of two types – old alluvium called bangar and new alluvium called khadar.

The alluvial soils have the following characteristics:

- Khadar is deposited in the flood plains and deltas, while bangar is found on the higher side of the river valleys.
- Khadar soils are more fertile than the bangar soils, as khadar are easily replenished by the recurrent floods in the rivers.
- Khadar soil is sandy and light in colour, while bangar soil is clayey and dark in colour.
- Khadar soils are finer in texture, while the bangar soils are coarse in texture.



India – Area under the alluvial soils

- The alluvial soils have adequate potash, phosphoric acid and lime, but are deficient in organic and nitrogenous contents.
- The alluvial soils are immature and thus have weak profiles.
- The alluvial soils are soft and porous and thus easily tillable.
- The alluvial soils are best suited for irrigation due to their softness and fertility.
- The old alluvium or bangar often contains lime modules, known as kankar.

Alluvial soils

- The alluvial soils can produce a variety of kharif and rabi crops, such as rice, wheat, maize, sugar cane, tobacco, cotton, jute, oilseeds and pulses

Black Soils

The black soil is locally called regur. This name has been derived from Telugu word reguda. It is also called the black cotton soil, as cotton is the most important crop grown in the black soil. The black soils are mostly found in Deccan Trap, which covers large areas in Maharashtra, Gujarat and western Madhya Pradesh.

The black soils are residual soils and have the following characteristics:

- The black soils are formed at the place of their origin and are thus called the residual soils.
- The black soils are made up of extremely fine textured clayey materials. The colour of the soils varies from black to chestnut brown.
- The black soils are well known for their capacity to hold moisture in their subsoil in any season. Thus, the black soils are suitable even for dry farming.
- During the hot dry season, the surface of black soils develops deep cracks, which helps in the circulation of air.
- During the rainy season, the black soils expandwhen wet and become sticky. It is difficult to till the wet soils as the plough gets stuck in the mud. Actually, the black soils should be tilled immediately after the first shower.

India – Area under black soils

- The black soil are rich in iron, calcium, alumina, potash, carbonates, magnesium, lime and humus. These soils are generally poor in nitrogen, phosphorus and organic matter.
- The black soils are deep and very fertile in river valleys and lowlands, but have low fertility in the uplands.
- The black soils can produce a variety of crops, such as cotton, sugar cane, wheat, millets, oilseeds, gram and tobacco. With proper irrigation facilities, even rice can be grown in black soils.

Black soils

Red Soils

Most of the red soils have been formed due to the weathering of igneous (ancient crystalline) and metamorphic rocks of the highlands in the peninsular plateau region of India.

Red soils

The red soils have the following characteristics:

- The red colour of the soil is due to the high percentage of iron oxide. In some parts, the colour varies from chocolate brown to yellow.
- The texture of the red soils varies from sandy to clayey and majority of them are loamy.
- In the lowlands, the red soils are deep, fine grained and fertile, while in the uplands, the red soils are thin, poor, porous and have loose gravel.
- The red soils are rich in potash, but poor in phosphoric acid, nitrogen, lime and humus.
- The red soils are generally shallow, loose and well aerated.
- The red soils are not very fertile and respond well to the proper use of fertilizers. The red soils also need irrigation support for producing crops.
- With proper doses of fertilizers and irrigation, red soils are suitable for growing cotton, wheat, rice, pulses, millets, oilseeds, tobacco, fruits, potatoes and vegetables.

India – Area under red soils

Laterite Soils

The word laterite has been derived from a Latin word meaning brick. According to most of the soil scientists, the laterite soils have been formed under conditions of high temperature and heavy rainfall, with alternate wet and dry periods. Such climatic conditions help in the leaching of soil. Leaching is a process in which heavy rains either wash away the fertile part of the soil or the nutrients in the soil are percolated downwards. In this process lime and silica are leached away.

India – Area under laterite soils

The laterite soils have the following characteristics:

- The laterite soils are porous and have a coarse texture. These soils cannot retain moisture.
- The laterite residual soils are mostly red in colour and are composed of gravel of red sandstone and small quantity of clay.

- The laterite soils are poor in lime, silica, potash and nitrogen, but have high contents of phosphates. These soils are rich in oxides of iron and aluminium compounds. Humus is reduced by bacteria which flourishes in high temperature.
- The laterite soils are less fertile due to intensive leaching. Thus, these soils are of low value for crop production.

Laterite soils

- When these soils are manured and timely irrigated, one can grow a variety of plantation crops at higher elevations, such as tea, coffee, rubber, coconut, cinchona, arecanuts, etc. In the low lying areas rice, sugar cane, cashew nuts, millets, etc., can be grown.

- In some areas, the laterite soils support pastures and scrub forests.
- The laterite soils are mostly acidic in nature, because the alkalis are leached away from the soils.
- The laterite soils provide valuable building materials, which are very durable.

SOIL EROSION

Soil erosion is the gradual removal of the topsoil cover by natural agencies, such as water, wind, etc. and also by human interference, like deforestation, overgrazing, improper farming, etc. The rate of soil erosion depends mainly upon:

1. the nature of soil,
2. the slope of ground,
3. the density of vegetation cover, and
4. the character of the rainfall.

Two natural agents, that is, water and wind are constantly causing soil erosion. The rainfall in India is in the form of heavy downpour. The run-off rainwater can wash away the topsoil. The erosion of soil due to water is of three types:

1. When the entire top sheet of the soil is carried away, leaving behind barren rocks, it is called sheet or surface erosion.
2. When the rainwater forms the finger shaped grooves in the soil, it is called rill erosion.

India – Major types of soil erosion

3. The enlargement of the rills can form deep gullies, which convert into ravines and badlands. It is called gully erosion.

Other factors which also cause soil erosion are deforestation, overgrazing mainly by sheep and goats, shifting agriculture by tribals, unscientific farming techniques, diversion of natural drainage system and unscrupulous mining activities.

Sheet erosion

Gully erosion

EFFECTS OF SOIL EROSION

Some of the adverse effects of soil erosion are as follows:

- Loss of fertile topsoil leads to the loss of agricultural productivity. u Floods and leaching of soils cause loss of mineral nutrients.
- Soil erosion causes the lowering of underground water table and thus decrease in soil moisture.
- The natural vegetation cover dries up and there is an expansion of arid and semi-arid lands.
- The intensity and frequency of floods and droughts increase.
- Rivers, canals and tanks are silted and their water holding capacity decreases.
- The incidence of landslides increases.
- There is an adverse effect on economic prosperity.
- The natural hideouts in ravines can lead to increase in crimes and antisocial activities. u Loss of vegetation can destroy the natural habitat for wildlife

SOIL CONSERVATION

Following methods are normally adopted for the prevention of soil erosion and conservation of soil.

Afforestation

The best way to conserve soil is to increase the area under forests. New trees should be planted in the areas of soil erosion and the old ones must be protected.

As far as possible, the trees should be planted in rows, especially in dry areas to avoid soil erosion. These trees can reduce the speed of winds which can erode the soil cover.

Check on Overgrazing

The animals, especially sheep and goats, overgraze in grasslands and forests. They also move freely in the cultivated fields and thus break the soil with their hoofs. This should be controlled by either growing fodder crop or developing separate grazing grounds.

Constructing Dams and Barriers

Most of the rivers during the rainy season cause heavy erosion of the soil. This can be prevented by controlling the flow of rivers by building dams across the rivers.

Check on Shifting Cultivation

Some tribals in India are still practising the ancient system of shifting cultivation. They should be persuaded by the tribal welfare organizations and the government to switch over to settled agriculture. Actually the shifting agriculture should be banned in India.

Use of Chemical Fertilizers

Most of the soils vary in fertility and in crop producing capability. Continuous cultivation can reduce the fertility of soil and may exhaust some of the essential nutrients in it. The fertility can be conserved by the application of organic manures and chemical fertilizers.

Land Use Planning

The Central Soil Conservation Board has prepared a number of plans for soil conservation in different parts of our country. These plans are based on the climatic conditions, relief of land and the social behaviour of the people. The integrated land use planning is one of the best techniques for proper soil conservation.

Changing Agricultural Practices

We can possibly save our valuable soils by adopting certain changes in our agricultural practices. Some of the possible changes are as follows:

Contour Ploughing: It involves the ploughing of land along the contours or across the slope of the land. It helps in checking the flow of water. It can reduce the run-off, so that the plants get more water

Contour ploughing and strip cropping

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Terracing and Contour Bunding:
Terracing along the mountain slopes is one of the oldest methods of soil conservation along the hill slopes. The slope of the hill is cut into a series of terraces. There is enough level land on terrace for cultivation. It checks the flow of water, promotes absorption of water by soil and thus reduces erosion.

Terraced farming

Crop Rotation: In our country, the farmers tend to grow a particular crop in the same field year after year. This practice can make the soil infertile and take away certain elements from it.

In the crop rotation system, different crops are cultivated on a piece of land each year. This helps in conserving soil fertility, as different crops needs different constituents from the soil.

Crop rotation

Strip Cropping: Crops should be grown in alternate strips. They should be parallel to one another. The various crops ripen at different times of the year and are harvested at intervals. Thus, the entire area will not be left exposed at any time. The tall-growing crops in one strip can also act as wind breakers.

Cover Cropping: In the plantations, the gestation period of tree crops is long. The cover crops may be grown between the young trees to protect the soil. The farmers can grow vegetables, which can provide extra income. Fallowing Sometimes it is important to allow the land to rest or lie fallow, so that the natural forces can act on the soil. This also increases the subsoil moisture and improves the general structure and texture of the soil.

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Additional Measures for Soil Conservation

We can adopt some of the following measures to achieve our goal:

- Construction of small dams across the tributaries of major rivers in upper reaches to control floods.
- Cementing the floor and sides of canals to avoid the seepage of canal water to avoid waterlogging.
- Development of wind breakers and shelter belts in arid and semi-arid regions.
- Reclamation of alkaline soil by using gypsum, etc.
- Increasing use of organic manure along with chemical fertilizers.
- Filling of gullies and forming terraces along the sloping surface.
- Leveling the ravines and planting of trees.
- Adopting new techniques of sustainable agriculture.

THANK YOU