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# SOIL AND WATER CONSERVATION

## Agriculture & Rural Development (ARD) Notes


FOR NABARD GRADE A EXAM

# Soil and Water Conservation

## ARD Notes for NABARD Gr. A Exam

### Types of Soil in India

#### 1. Alluvial Soil

- Less phosphorous
- Found mainly in the Satluj- Ganga- Brahmaputra Plains, the valleys of the Narmada, Tapi, and the Eastern and Western coastal plains.
- Suited for Rice, maize, wheat, sugarcane, oilseeds, etc.

**Types of Alluvial Soil**

- **Khadar Soil (New):** Enriched with fresh silts. They are low lying, frequently inundated by floods during the rainy season. It occupies the flood plains of rivers.
- **Bhangar Soil (Old):** Lies above the flood level. It is well-drained but because of the calcium carbonate nodules, the texture of soil varies from loamy soil to clayey soil.

#### 2. Red Soil (known as the omnibus group)

- This soil developed on Archean granite occupies the second largest area of the country.
- Mainly found in the Peninsula from Tamil Nadu in the south to Bundelkhand in the north and Raj Mahal in the east to Kathiawad in the west.
- Deficient in phosphate, lime, magnesia, humus and nitrogen, presence of ferric oxides makes the colour of soil red,
- Good for the cultivation of wheat, cotton, pulses, tobacco, millets, orchards, potato, and oilseeds.

#### 3. Black or Regur Soil (rocks of cretaceous lava)

- The soil is rich in iron, lime, calcium, potash, magnesium, and aluminium. It has high water retaining capacity.

- Stretch over the parts of Gujarat, Maharashtra, Western parts of Madhya Pradesh, North-Western Andhra Pradesh, Karnataka, Tamil Nadu, Rajasthan, Chhattisgarh, Jharkhand up to Raj Mahal hills.
- Good for cotton cultivation, Tobacco, citrus fruits, castor, and linseed.

**4. Desert Soil**

- They are sandy with low organic matter.
- It has low soluble salts and moisture with very low retaining capacity.
- If irrigated this soil give a high agricultural return.
- This soil is deposited by wind action and mainly found in the arid and semi-arid areas like Rajasthan, West of the Aravallis, Northern Gujarat, Saurashtra, Kachchh, Western parts of Haryana and southern part of Punjab.
- These are suitable for less water-intensive crops like Bajra, pulses, fodder, and guar.

**5. Laterite Soil**

- These are poor in organic matter, nitrogen, potassium, lime, and potash. These iron and aluminium rich soils.
- Raj Mahal hills, Eastern Ghats, Satpura, Vindhya, Odisha, Chhattisgarh, Jharkhand, West Bengal, North Cachar Hills and the Garo hills.
- Suitable for the cultivation of rice, ragi, sugarcane, and cashew nuts.

**6. Mountain Soil (immature and dark brown)**

- This soil has very low humus and is acidic.
- The orchards, fodder, legumes are grown in this soil.

**7. Grey and Brown Soil**

- It is formed by the weathering of granite, quartzite, and gneiss.
- These loose, friable soils contain iron- oxide (haematite and limonite).
- These soils are found in Rajasthan and Gujarat

### 8. Submontane Soil

- These are formed by the deposition of eroded material from Shiwaliks and the lesser Himalayas.
- These are found in the Tarai region of the submontane stretching from Jammu and Kashmir to Assam.
- The soil supports a luxuriant growth of forest and is more prone to soil erosion.

### 9. Karewa Soil

- The fine silt, clay, and boulder gravels are the composition of Karewa soil.
- They are characterized with the fossils.
- Karewa soils are the lacustrine deposits in the Kashmir valleys and Bhadarwah valleys.
- Mainly devoted to the cultivation of saffron, almonds, apple, walnut, etc.

### 10. Peaty and Marshy Soils

- Atter and has high salinity.
- Deficient in potash and phosphate.
- Mainly found in Sunderbans delta, Kottayam, and Alappuzha districts of Kerala, Rann Kachchh, deltas of Mahanadi, etc.

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## Soil Fertility

**Soil Fertility - "ability of the soil to sustain plant growth."**

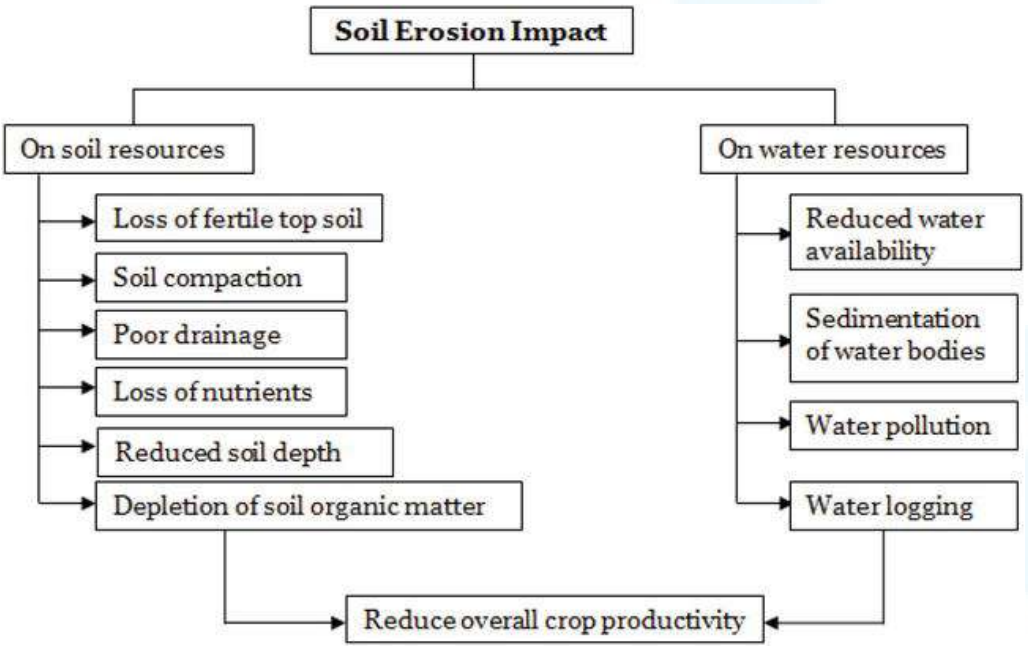
- Fertile soil results in a high yield and better quality of plants.
- Fertile soil is rich in fundamental elements and minerals, has good aeration, water holding capacity, and good texture.

### Factors Affecting Soil Fertility

- **Mineral Composition**- Helps to predict the ability of the soil to retain plant nutrients. Proper fertilizers and manures help in enhancing the quality of the soil.
- **Soil pH-** Helps in maintaining the nutrient availability of the soil. A pH range between 5.5-7 is optimum for soil fertility.
- **Soil Texture-** The minerals of different sizes are responsible for maintaining the structure of the soil, Clayey soil can retain more nutrients (acts as a nutrient reservoir).
- **Organic Matter -** It is a source of nitrogen and phosphorus.

## Soil Erosion

Soil particles are loosened or washed away in the valleys, oceans, rivers, streams or faraway lands, Soil erosion is a continuous process that occurs either slowly or at an alarming rate, it results in a continuous loss of topsoil, ecological degradation, soil collapse, etc.



## Causes of Soil Erosion

**1. Rainfall and Flooding**: Higher intensity of rainstorm is the main cause of soil erosion, four types of soil erosion are caused by rainfall:

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

The raindrops disperse the soil, which is then washed away into the nearby streams and rivers, Regions with very heavy and frequent rainfall face a large amount of soil loss, The flowing water during floods also erodes a lot of soil by creating potholes, rock-cut basins, etc.

**2. Agriculture**: The farming practices are the major cause of soil erosion. The agricultural activities disturb the ground, The trees are cleared, and the land is ploughed to sow new seeds, most of the soil is eroded during winters, the tyres of tractors make grooves on the land, making a natural pathway for water, Fine soil particles are eroded by wind.

**3. Grazing:** The grazing animals feed on the grasses and remove the vegetation from the land, their hooves churn up the soil, they also pull-out plants by their roots, this loosens the soil and makes it more prone to erosion.

**4. Logging and Mining:** A large number of trees are cut down to carry out the logging process, Trees hold the soil firmly, the canopy of the trees protects the soil from heavy rainfall, The leaf litter that protects the soil from erosion, is also lost during logging, Mining activities also disturb the land and leave the soil more prone to erosion.

**5. Construction:** The construction of roads and buildings exposes the soil to erosion, The forests and grasslands are cleared for construction purposes, which exposes the soil making it vulnerable to erosion.

## Effects of Soil Erosion

**1. Loss of Arable Land:** The degraded soil does not support crop production and leads to low crop productivity.

**2. Clogging of Waterways:** The agricultural soil contains pesticides, insecticides, fertilizers, and several other chemicals.

This pollutes the water bodies where the soil flows.

The sediments accumulate in the water and raise the water levels resulting in flooding.

**3. Air Pollution:** The dust particles merge in the air, resulting in air pollution. such as pesticides and

petroleum can be extremely hazardous when inhaled. The dust plumes from the arid and semi-arid regions cause widespread pollution when the winds move.

**4. Desertification:** It transforms the habitable regions into deserts. Deforestation and the destructive use of land worsen the situation. This also leads to loss of biodiversity, degradation of the soil, and alteration in the ecosystem.

**5. Destruction of Infrastructure:** The accumulation of soil sediments in dams and along the banks can reduce their efficiency. Thus, it affects infrastructural projects such as dams, embankments, and drainage.

## Soil Erosion Prevention

**Following methods are normally adopted for conserving soil:**

**1. Afforestation:** to increase the area under forests. Undiscriminating tree cutting should be stopped and made to plant trees in new areas.

**2. Checking Overgrazing:** overgrazing of forests and grasslands by animals, especially by herds and flocks of sheep, goats.

**3. Constructing Dams:** By the river, floods can be avoided by constructing dams across the rivers. Water speed can be checked, and it considerably saves soil from erosion.

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**4. Changing Agricultural Practices:** Certain changes in our agricultural practices. As described below:

i. **Crop Rotation:** In India, peasants grow a particular crop in the same field year after year. This practice takes away certain elements from the soil, making it infertile and rendering it unsuitable for that crop.

ii. **Strip Cropping:** Crops may be cultivated in alternate strips. Some strips may be allowed to lie fallow while in others different crops may be sown e.g., small tree crops, grains, grass legumes, etc. Numerous yields ripen at diverse times of the year and are harvested at intervals.

iii. **Use of Early Maturing Varieties:** Primary budding varieties of crops take really very less time to mature. Thus, putting lesser pressure on the soil.

iv. **Contour Ploughing:** Ploughing is done at right angles to the hill slope, following the natural contours of the hill. It makes the ridges and furrows break the flow of water down the hill. As gullies are less, this prevents excessive soil loss. It is likely to develop and reduce run-off so that plants receive more water.

v. **Terracing and Contour Bunding:** One of the oldest methods of soil conservation. It is done across the hill slopes are very effective, done by cutting hill slope into a number of terraces having horizontal top and steep slopes on the back and front.

vi. **Checking Shifting Cultivation:** It is mainly used by tribal. Tribals to switch over to settled agriculture by checking shifting cultivation. Arrangements for tribal resettlement can help to make them understand the new way of cultivation.

vii. **Ploughing the Land in Right Direction:** Ploughing the land in a perpendicular direction to wind direction reduces wind velocity and protects the topsoil from erosion.

## Soil Fertility

The ability of soil to sustain agricultural plant growth, i.e., to provide plant habitat and result in sustained and consistent yields of high quality.

**Fertile soil has the following properties:**

- The ability to supply essential plant nutrients and water in adequate amounts and proportions for plant growth and reproduction; and
- The absence of toxic substances which may inhibit plant growth.
- The following properties contribute to soil fertility in most situations.
- Sufficient soil depth for adequate root growth and water retention.
- Good internal drainage, allowing sufficient aeration for optimal root growth (although some plants, such as rice, tolerate waterlogging);

- Topsoil or horizon O is with sufficient soil organic matter for healthy soil structure and soil moisture retention.
- Soil pH in the range 5.5 to 7.0 (suitable for most plants but some prefer or tolerate more acid or alkaline conditions).
- Adequate concentrations of essential plant nutrients in plant-available forms.
- Presence of a range of microorganisms that support plant growth.

## Fertilizers

Fertiliser is a substance that is used to make the soil more fertile such as manure or a mixture of nitrates. It is applied to the soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants.

**Classification of Fertilizers: -**

1. **Various nitrogenous chemical fertilizers-** ammonium sulphate, calcium ammonium nitrate, basic calcium nitrate, calcium cyanamide (nitrolium), urea etc. these fertilizers supply nitrogen to the soil.
2. **Various phosphatic chemical fertilizers -** superphosphate of lime, triple superphosphate etc and potash chemical fertilizers like potassium chloride, potassium nitrate, potassium sulphate etc.
3. **Some chemical fertilizers of different compositions** like of nitrogen phosphorus (NP) fertilizers in which nitrogenous and phosphatic fertilizers are mixed up in a definite and proper ratio. The fertilizers like dehydrogenate ammoniated phosphate, calcium superphosphate etc are NP fertilizers.

## Watershed Management:

- A Watershed is defined as a geo-hydrological unit draining to a common point by a system of drains.
- A watershed is an area of land and water bounded by a drainage divide within which the surface runoff collects and flows out of the watershed through a single outlet into a larger river or lake.
- Watershed technology is used in Rainfed areas.
- Watershed management implies effective conservation of soil and water resources for sustainable production with minimum non-point resources (NFS) pollutant losses.

- It involves management of land surface and vegetation so as to conserve the soil and water for immediate and long-term benefits to the farmers, community, and society as a whole.
- The catchment area is the water collecting area. “All the areas from which water flows out into a river or water pool”.

**Types of Watershed Management:**

Classified depending upon the size, drainage, shape, and land use pattern.

a. Macro watershed: 1000 -10,000 ha

b. Micro watershed: 100 -1000 ha

c. Mini watershed: 10 -100 ha

d. Mille watershed: 1 -10 ha

**Objectives of Watershed Management:**

**a.** Production of food, fodder, fuel.

**b.** Pollution control

**c.** Overexploitation of resources should be minimized

**d.** Water storage, flood control, checking sedimentation.

**e.** Wildlife preservation

**f.** Erosion control and prevention of soil, degradation and conservation of soil and water.

**g.** Employment generation through industrial development dairy fishery production.

**h.** Recharging of groundwater to provide regular water supply for consumption and industry as well as irrigation.

**i.** Recreational facility.

**Main Components of Watershed:**

a. Soil and water conservation,

b. Water harvesting and water management,

c. Alternate land-use system.

**Rainwater Harvesting**

Rainwater harvesting means the collection and storage of rainwater by some mechanism to make water available for future use. An appreciable amount of precipitation, which is generally lost as surface flow, can be harvested, and stored for useful purposes like drinking and providing supplemental irrigation to the crops.

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