

SAGE IAS ACADEMY

Mentorship by Shashank Sir

BIO-GEOGRAPHY

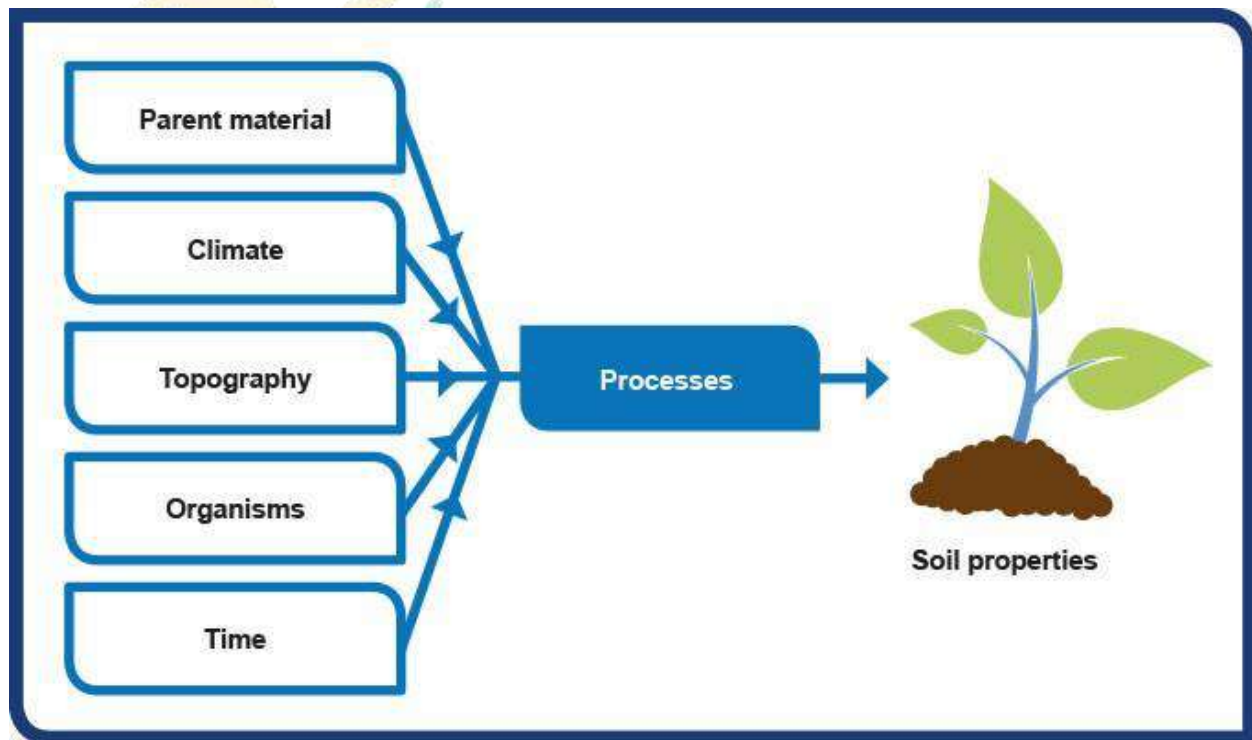
SOILS

MOST IMPORTANT TOPIC ANALYSIS

Soil:

“The science dealing with soil as a natural resource on the surface of the earth, including Pedology (soil genesis, classification and mapping), physical, chemical, biological and fertility properties of soil and these properties in relation to their management for crop production.

Pedology is the study of soil and pedogenesis refers to the processes involved in the formation of soils



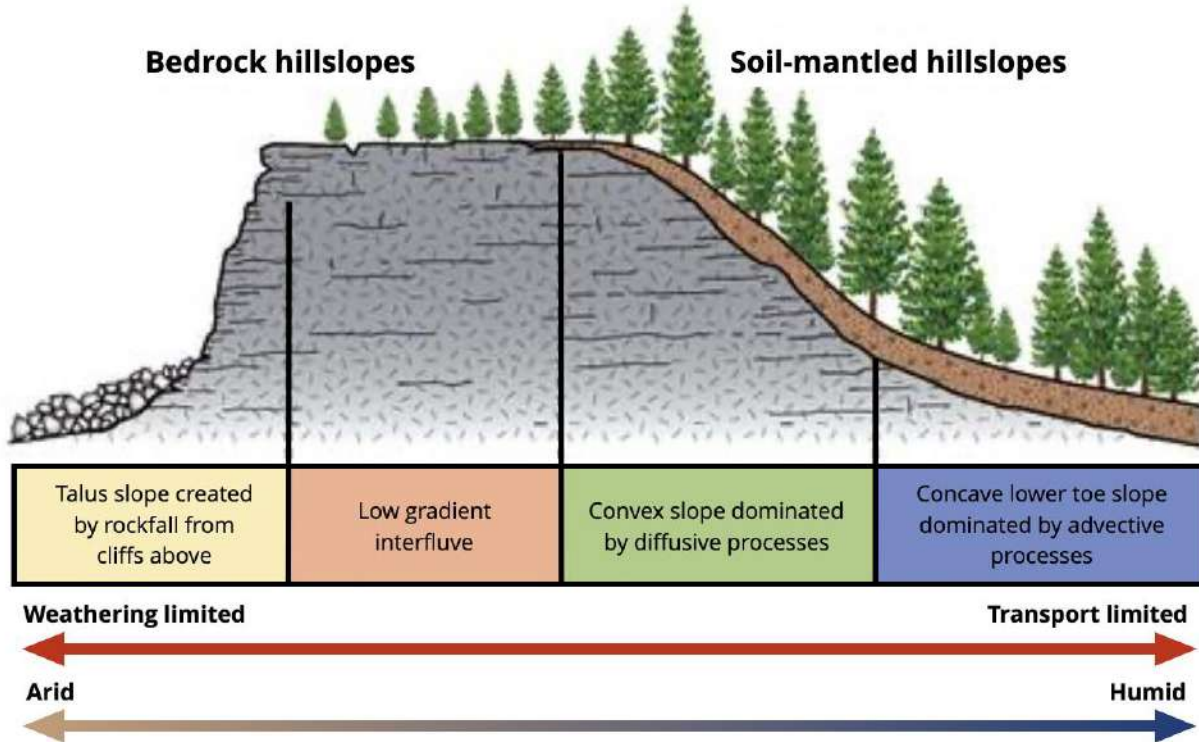
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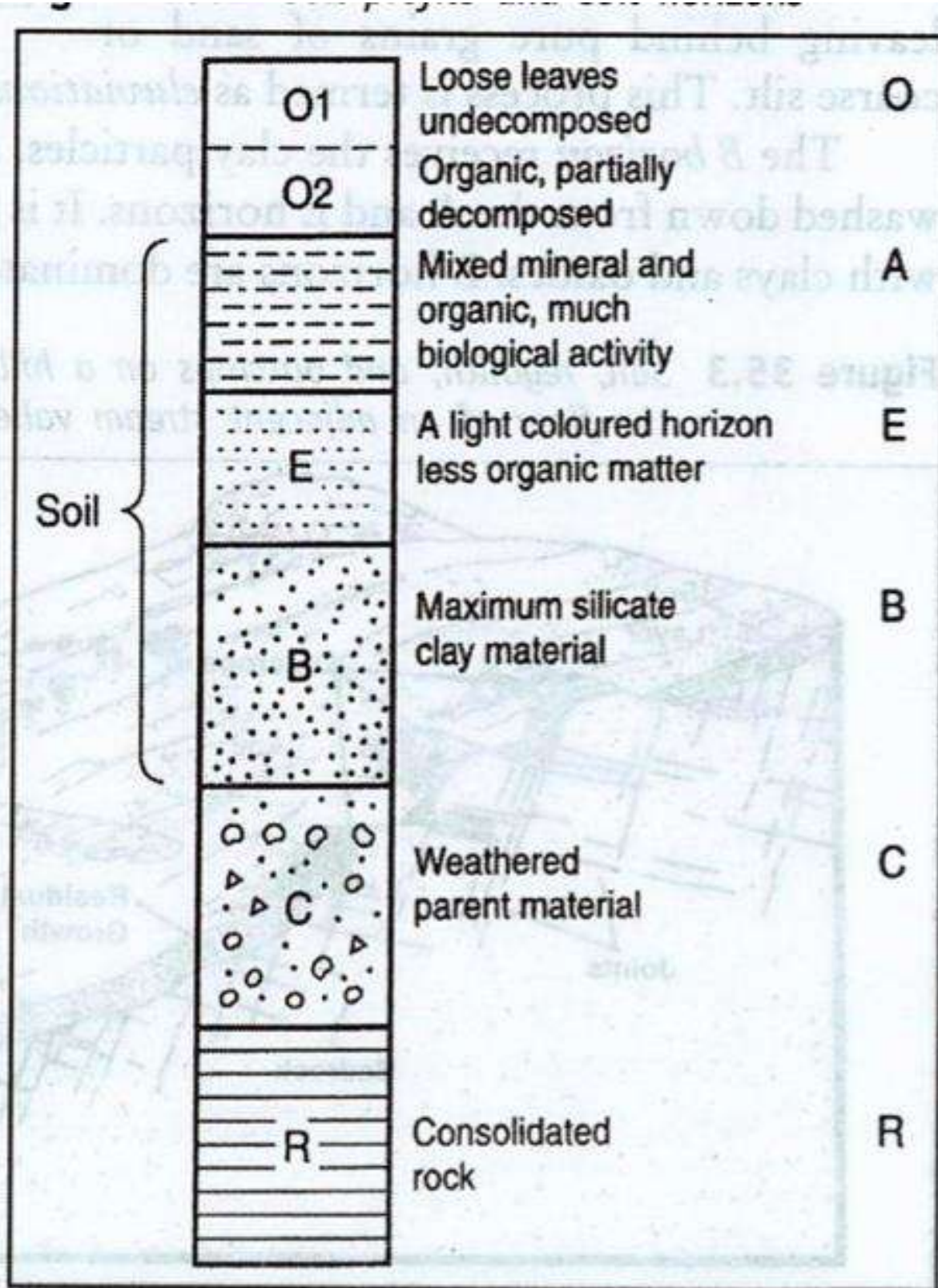
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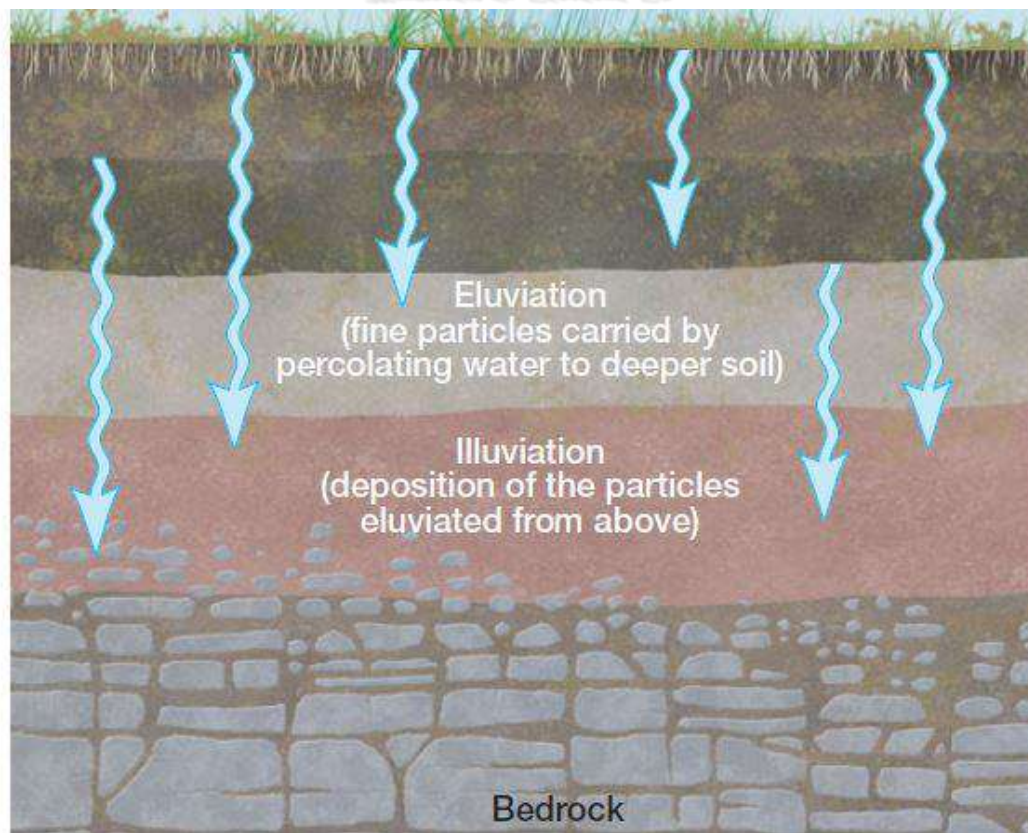
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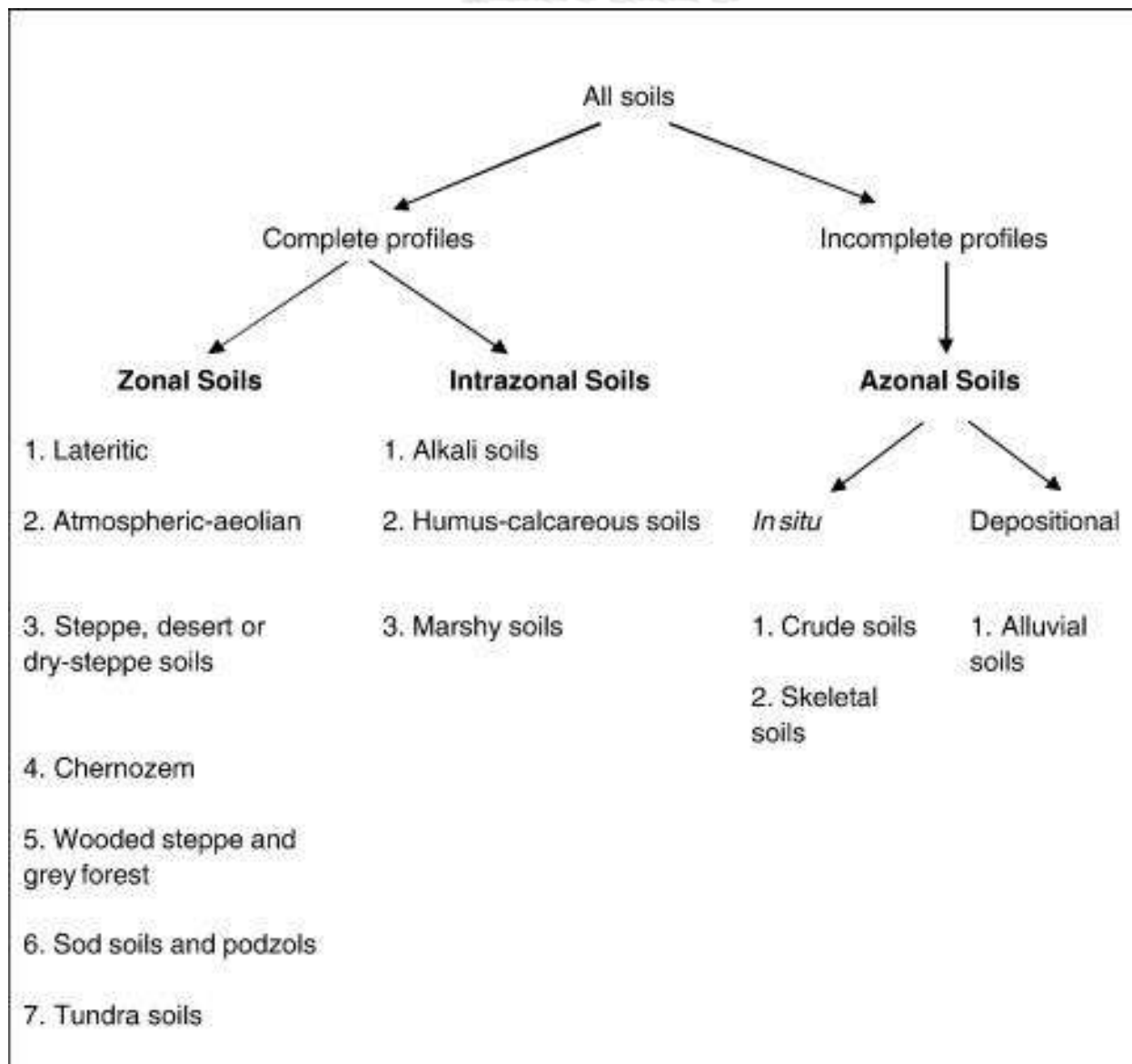
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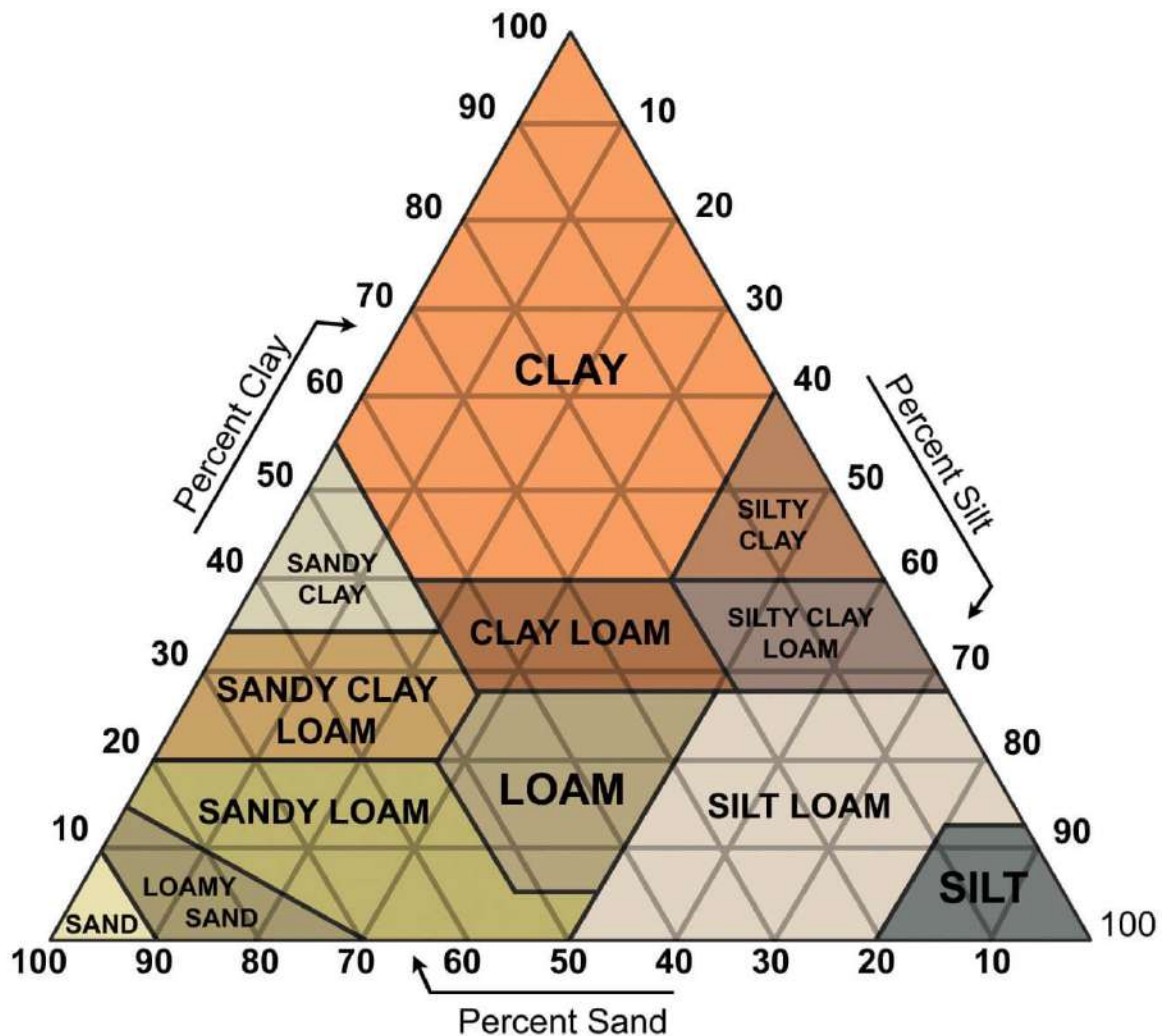
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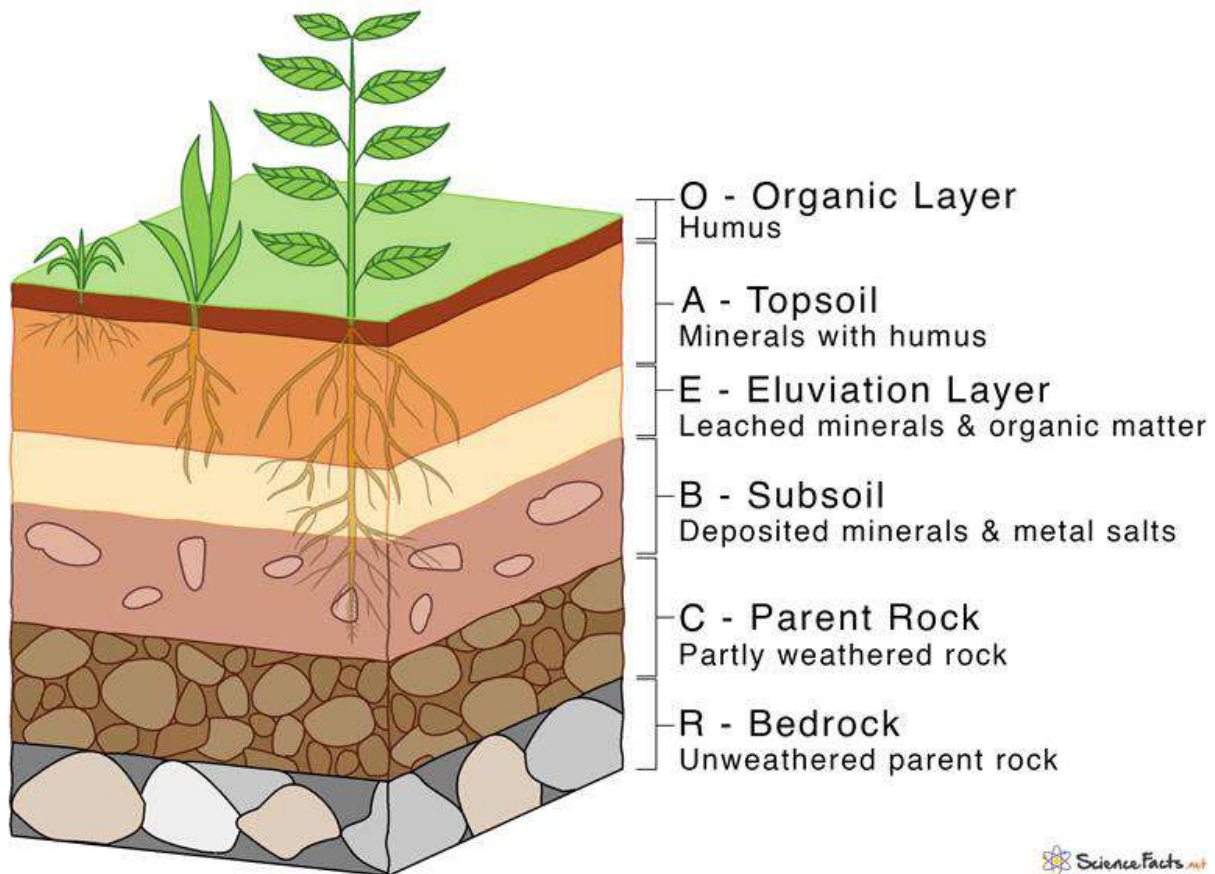
By weight, its mineral composition is about 40–40–20% concentration of sand–silt–clay, respectively

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Soil Horizons



In a simple way, we can consider a "Pedin" as a 3-D structure (minimum 1 m² surface up to 10 m²) that contain all the properties of the studied soil.

The soil profile is defined as a vertical section of the soil from the ground surface downwards to where the soil meets the underlying rock (USDA Soil Taxonomy). In this way, a soil profile could be one of the vertical face of a pedon.

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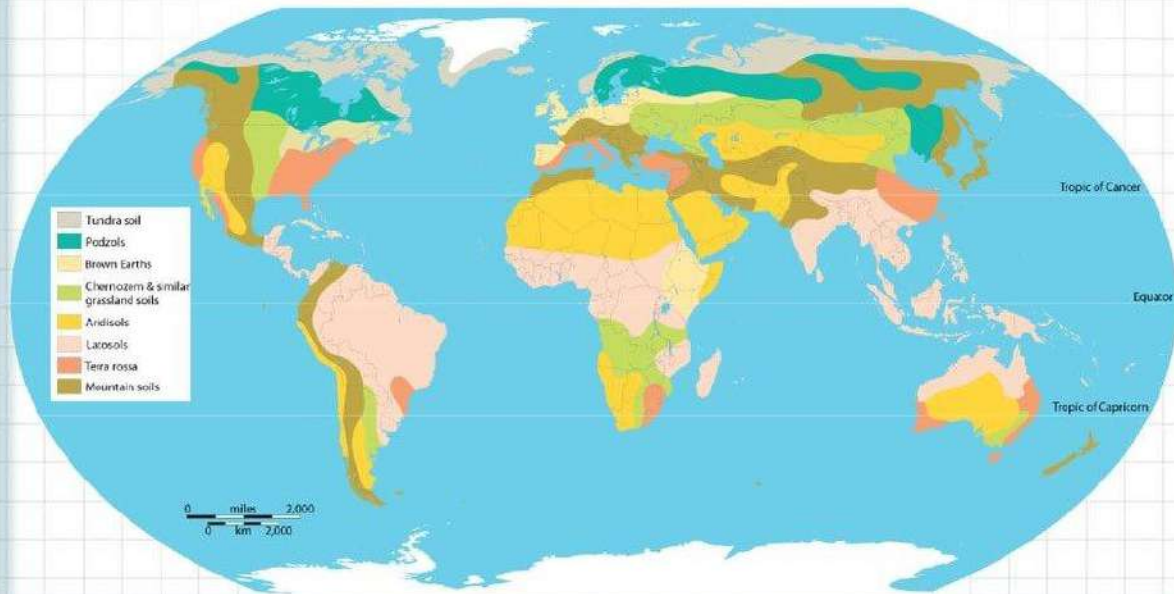
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- Zonal soils
- Intrazonal soils
- Azonal soils



Loess near Hunyuan, Datong, Shanxi, China

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Table 35.2 A simplified classification of major soil types

Soil Type	Latitudinal Location	Types
Zonal Soils	A. High latitude climates	1. Tundra soils
		2. Arctic brown soils
	B. Mid-latitude climates (humid)	3. Podzol
		4. Grey-brown podzols
	Seasonal rainfall	5. Brown earth or brown forest soil
	Semi-arid and arid	6. Chernozem
		7. Chestnut-coloured soils
		8. Cool desert soils (grey earth or sierozems)
	C. Low latitude climates (humid)	9. Latosol
		10. Tropical black earth (basisol)
	Arid	11. Red desert soils
Intrazonal Soils	A. Due to saline content	12. Solonchak
		13. Solonetz
	B. Due to excessive moisture	14. Meadow soils
		15. Fen-peat soils
		16. Bog-peat soils
		17. Dry-peat soils
	C. Due to calcareous parent material	18. Rendzina
		19. Terra Rossa
		20. Red, brown and cinnamon Mediterranean soils
		21. Brown calcareous soils
Azonal Soils (Immature and Skeletal Soils)	A. Mountain soils	22. Scree soils
	B. Alluvial soils	23. River-borne material
	C. Marine soils	24. Salt-marsh soils, mud-flat soils, marine clays
	D. Glacial soils	25. Till soils, fluvioglacial soils
	E. Aeolian (wind-blown) soils	26. Dune soils, loess soils
		27. Limon soils
	F. Volcanic soils	28. Recent lava and ash soils

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Table 35.3 Soil taxonomy: Soil order

Order	Pronunciation	Derivation of Term	Marbut Equivalent (Canadian)	General Location and Climate	World Land Area (%)	Description
1. Oxisols	ox	Fr. Oxide Gr. Oxide (acid or sharp)	Lateritic soil	Tropical soils (hot-humid areas)	9.2	Maximum weathering and eluviation, oxic-horizon, continuous plinthite layer.
2. Aridisols	arid	L.Aridos (dry)	Reddish desert, grey desert (sierozems)	Desert soils, hot dry areas	19.2	Limited alteration of parent material, low climate activity, light colour, sub-surface illuviation of carbonates.
3. Mollisols	mollify	L.Mollis (soft)	Chestnut, Chernozem (Chernozemic)	Grassland soils sub-humid (semi-arid lands)	9.0	Noticeably dark with organic material (humus).
4. Alfisols	alfafa	Invented syllable	Grey-brown podzolic, degraded chernozem	Moderately weathered forest soils (humid temperate forests)	14.7	B horizon high in clays, moderate to high degree of base saturation, no pronounced colour change of depth.
5. Ultisols	ultimate	L.Ultimus (last)	Red-yellow podzolic, reddish yellow	Highly weathered forest soils (subtropical forests)	8.5	Similar to alfisols, B horizon high in clays, redder than alfisols.
6. Spodosols	odd	L. Spodes 'woodash'	Podzolic, brown podzolic	Conifer forest soils (cool humid forests)	5.4	Highly leached, strongly acid, coarse texture of low bases.
7. Entisols	recent	Invented syllable	Azonal soils, (tundra)	Recent soil profile (all climates)	12.5	Young soils, lacking horizon.
8. Inceptisols	inception	L. inception 'beginning'	Subarctic brown forest lithisols	Weakly developed soils (humid regions)	15.8	Intermediate development, further weathering possible.
9. Vertisols	invert	L.verto 'to turn'	Tropical black clays	Subtropics, tropics, sufficient dry period	2.1	Forms large cracks on drying.
10. Histosols	histology	Gr. histos 'tissue'	Peat, bog (organic)	Organic soil (wet places)	0.8	Peat or bog > 20% organic matter, no horizon.
11. Andisols	—	Volcanic ash	—	Areas affected by frequent volcanic activity	< 1.0	Volcanic parent materials, high organic content, generally fertile.

Source: Christopherson (1995: pp. 464–65).

Soils of India

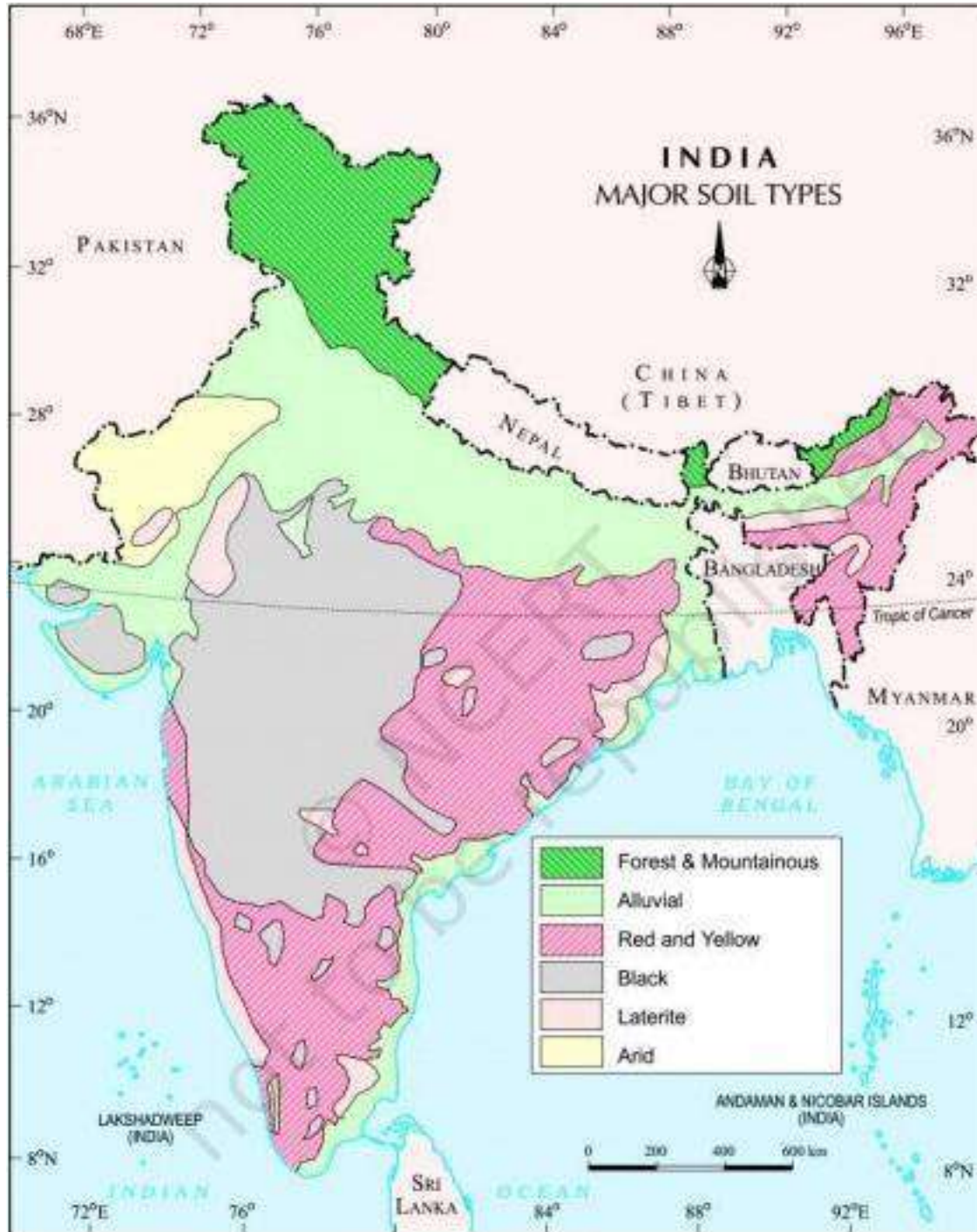
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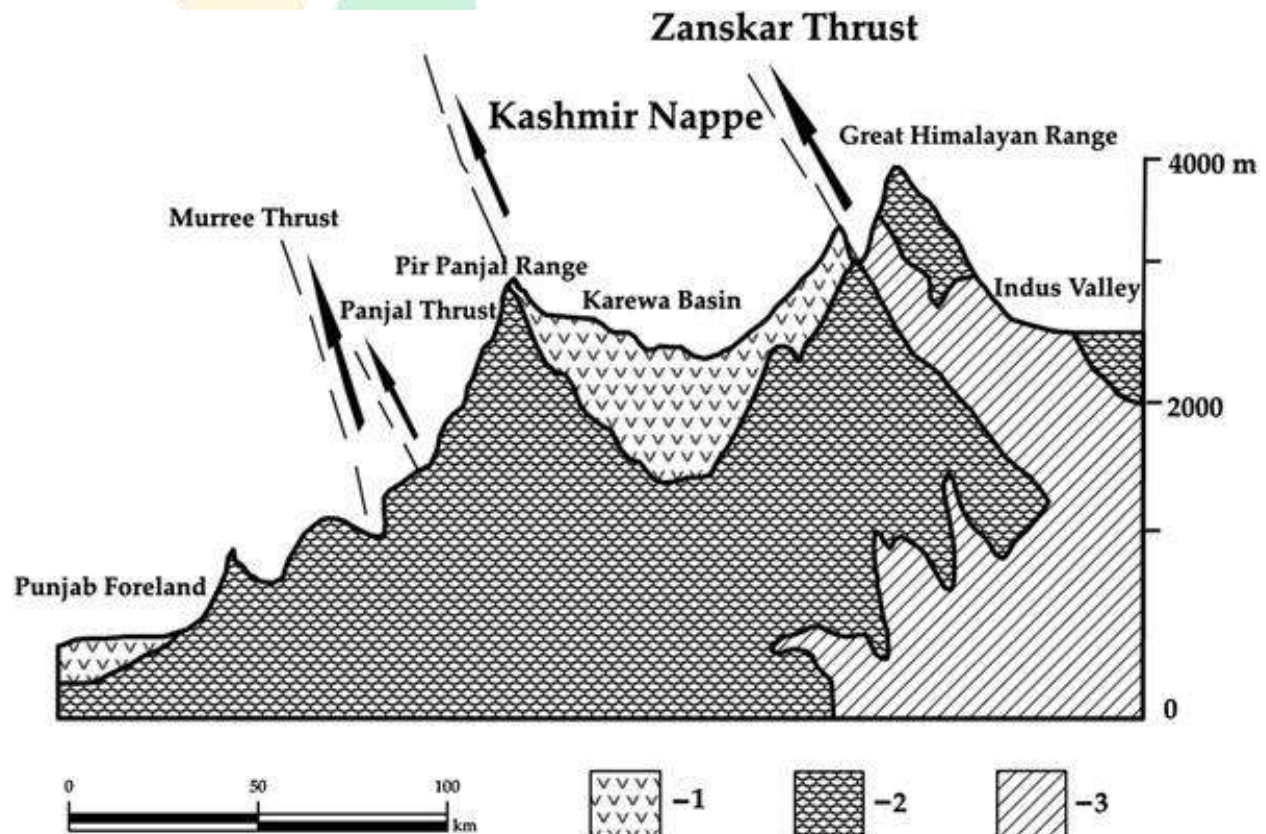
Different Types of Soil in India

In the ancient period, soils were mainly classified into two – Urvara (fertile) and Usara (sterile).

The first scientific classification of soil was done by Vasily Dokuchaev. In India, the Indian Council of Agricultural Research (ICAR) has classified soils into 8 categories. They are:

1. Alluvial Soil
2. Black Cotton Soil
3. Red & Yellow Soil
4. Laterite Soil
5. Mountainous or Forest Soil
6. Arid or Desert Soil
7. Saline and Alkaline Soil
8. Peaty and Marshy Soil

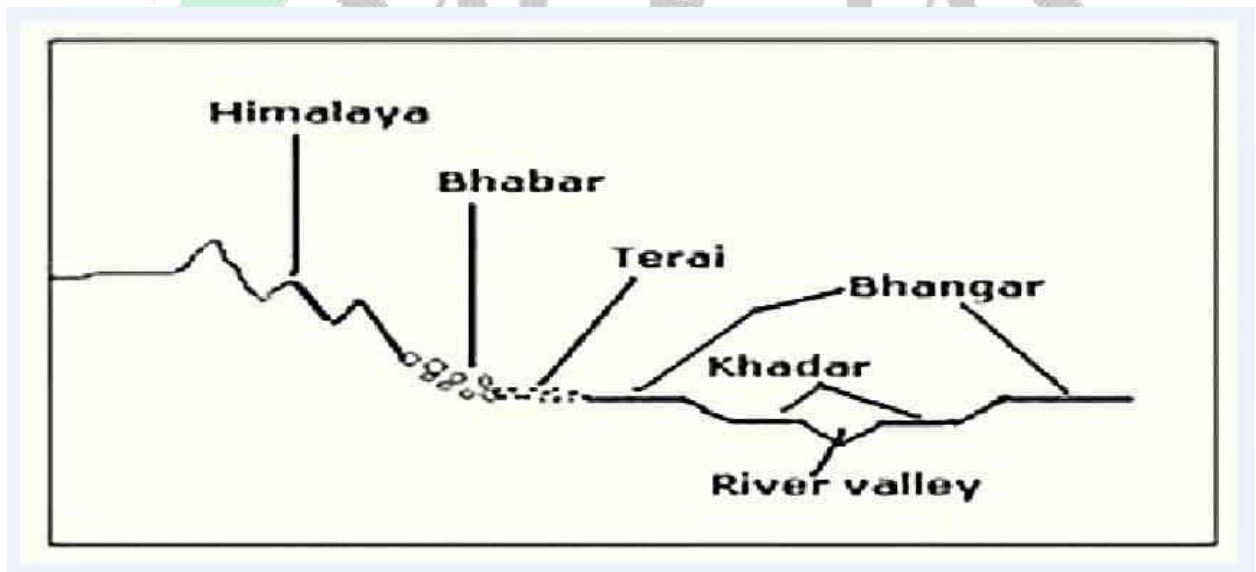
As mentioned before, there are eight types of soils categorized by ICAR but some Indian Soils like – Karewa soil, Sub-Montane Soil, Snowfield, Grey/Brown Soil are all sub-types of main Indian Soil. Let's read about them one by one:



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Types of Soil in India – Alluvial Soil

- Alluvial soils are widespread in the northern plains and river valleys.
- It covers about 40% of the total land area of the country.
- These soils are mainly derived from the debris brought down from the Himalayas.
- In the Peninsular region, they are found in deltas of the east coast and in the river valleys.
- The colour of the alluvial soil varies from light grey to ash grey.
- The alluvial soil varies in nature from sandy loam to clay.
- They are rich in potash but poor in phosphorus.
- Two different types of alluvial soils have developed in the Upper and Middle Ganga plains – Khadar and Bhangar.
 - Khadar is the new alluvium and occupies the flood plains of the rivers. Khadar is enriched with fresh silt deposits every year.
 - Bhangar is the old alluvium, deposited away from the flood plains.
- Both Khadar and Bhangar soils contain concretion (kankars) of impure calcium carbonate.
- These soils are more loamy and clayey in the lower and middle Ganga plains and the Brahmaputra valley.
- Alluvial soils are intensely cultivated – wheat, maize, sugarcane, pulses, oilseed, etc. are mainly cultivated.



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Types of Soil in India – Red & Yellow Soil



- Also known as the “omnibus group”.
- It covers about 18.5 % of the total land area of the country.
- It is found in regions of low rainfall (eastern and southern parts of the Deccan Plateau). Along the piedmont zone of the Western Ghats, a long stretch of area is occupied by red loamy soil. This soil is also present in parts of Odisha and Chattisgarh and in the southern parts of the Middle Ganga Plain.
- The red colour is due to the presence of iron in crystalline and metamorphic rocks. The soil appears yellow when it is in hydrated form.
- The fine-grained red and yellow soil is usually fertile while the coarse-grained soil is less fertile.
- This type of soil is generally deficient in nitrogen, phosphorus and humus.
- Wheat, cotton, oilseeds, millets, tobacco, pulses are mainly cultivated in red and yellow soil.

Types of Soil in India – Black or Regur Soil



- Black soil is also known as “Regur Soil” or the “Black Cotton Soil”.
- It covers about 15% of the total land area of the country.
- It covers most of the Deccan Plateau – parts of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and some parts of Tamil Nadu. In the upper reaches of the Godavari and Krishna, and the north-western part of Deccan Plateau, the black soil is very deep.
- The colour of these soils varies from deep black to grey.
- The black soils are generally clayey, deep and impermeable. They swell greatly and become sticky when wet in the rainy season. In the dry season, the moisture evaporates, the soil shrinks and develops wide cracks.

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- Black soils are rich in iron, lime, aluminium, magnesium and also contain potassium. However, these soils are deficient in nitrogen, phosphorus and organic matter.
- Cotton, pulses, millets, castor, tobacco, sugarcane, citrus fruits, linseed, etc. are mainly cultivated in black soil.

Types of Soil in India – Desert Soil



- Also known as arid soil, it accounts for over 4.42 % of the total land area of the country.
- The colour ranges from red to brown.
- Desert soils are sandy to gravelly in texture, have low moisture content and low water-retaining capacity.
- These soils are saline in nature and in certain regions the salt content is so high that common salt is obtained by evaporating water.
- These soils have normal phosphate content but are deficient in nitrogen.
- Due to increased calcium content in the lower horizons of the soil, there is the formation of ‘kankar’ layers. These kankar layers restrict the penetration of water and as such when water is made available through irrigation, the soil moisture is readily available for sustainable plant growth.
- Desert soils are profoundly found in western Rajasthan and contain little humus and organic matter.

Laterite Soil



- The name has been derived from the Latin word “later” which means brick.
- It accounts for about 3.7% of the total area of the country.
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- These are typical soils of the monsoon climate which is characterised by seasonal rainfall. With rain, lime and silica are leached away, and soil rich in iron oxide and aluminium are left leading to the formation of laterite soil.
- Laterite soil is deficient in organic matter, nitrogen, phosphate and calcium, however iron oxide and potash are in abundance.
- Although low in fertility, they respond well to manures and fertilisers.
- Laterite soils are found in Karnataka, Tamil Nadu, Kerala, Madhya Pradesh and hilly regions of Assam and Odisha.
- Red laterite soil in Kerala, Tamil Nadu and Andhra Pradesh are well suited for tree crop cultivation like cashew nuts.
- Laterite soil hardens rapidly and irreversibly on exposure to the air, a property that leads to its use as building bricks in southern India.

Mountain Soil



- This type of soil is found in the forest regions where rainfall is sufficient.
- The texture of the soil depends on the mountain environment where they are found.
- These soils are coarse-grained in the upper slopes and loamy and silty on valley sides.
- In the snowbound areas of the Himalayas, these soils undergo denudation and are acidic with low humus content. The soils found in the lower valleys are fertile.
- Also called forest soil.

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Peaty and Marshy Soils



- These soils are found in regions of heavy rainfall and high humidity, and it supports the good growth of vegetation.
- Peaty soils are rich in humus and organic matter.
- These soils are generally heavy and black in colour. In many places, these soils are alkaline.
- These are found in southern Uttarakhand, the northern part of Bihar, and the coastal areas of West Bengal, Odisha and Tamil Nadu.

Saline and Alkaline Soils

- These soils have high percentages of sodium, magnesium and potassium, and hence are infertile. The high salt content is mainly because of the dry climate and poor drainage.
- The texture ranges from sandy to loamy.
- These soils are found in arid and semi-arid areas, and in waterlogged and swampy regions.
- These soils are deficient in calcium and nitrogen.
- These soils are mostly found in western Gujarat, deltas of the eastern coast and in Sundarban areas of West Bengal. In the Rann of Kutch, the south-western monsoon brings salt particles and deposits there as a crust. Seawater near deltas also increases the salinity of the soil.
- These soils can be reclaimed by improving drainage, by applying gypsum or lime and by cultivating salt-resistant crops like berseem, dhaincha, etc.
- These are also called Reh, Usar, Kallar, Rakar, Thur, and Chopan. These are mainly found in Rajasthan, Haryana, Punjab, Uttar Pradesh, Bihar, and Maharashtra. Sodium chloride and sodium sulphate are present in this soil. It is suitable for leguminous crops.

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Red and Black Soil

These are developed over the granite, gneiss, and quartzite of the Precambrian and Archean eras. This soil performs well if irrigated. Generally, this soil has very little productivity.

Grey and Brown Soil

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

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.

Snowfields

This soil was found under the snow and glaciers at the highest peak of the greater Himalayas, Karakoram, Ladakh, and Zaskar. This soil is immature and unsuitable for crops.

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Karewa Soil

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



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