



## **Factors Responsible for the Formation of Soil**

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*Site Reference:* <https://www.civildaily.com/factors-that-affect-soil-formation-parent-material-climate-relief-vegetation-time-soil-profile-soil-horizons/>

The major factors responsible for the formation of soil:

The major factors affecting the formation of soil are relief, parent material, climate, vegetation and other life-forms and time. Besides these, human activities also influence it to a large extent.

### **1. Parent Material**

The parent material of soil may be deposited by streams or derived from in-situ weathering. Soil inherits many properties from the parent material from which it forms, for example, the mineral composition, the colour, the particle size and the chemical elements.

For Example,

- The peninsular soils reflect the parent rock very much.
- The ancient crystalline and metamorphic rocks which are basically granite, gneiss and schist form red soils on weathering because they contain iron oxide.
- Soils derived from lava rocks are black coloured.
- Sandy soils are derived from sandstone.
- At the same time, the soils of the northern plains are transported and deposited from Himalayan and peninsular blocks, so they have little relation to rock material in-situ.

### **2. Climate**

The role of climate is to vary the inputs of heat and moisture. It affects the rate of weathering of the parent rock. Hot and humid environments, in general, witness the most rapid weathering of parent materials.

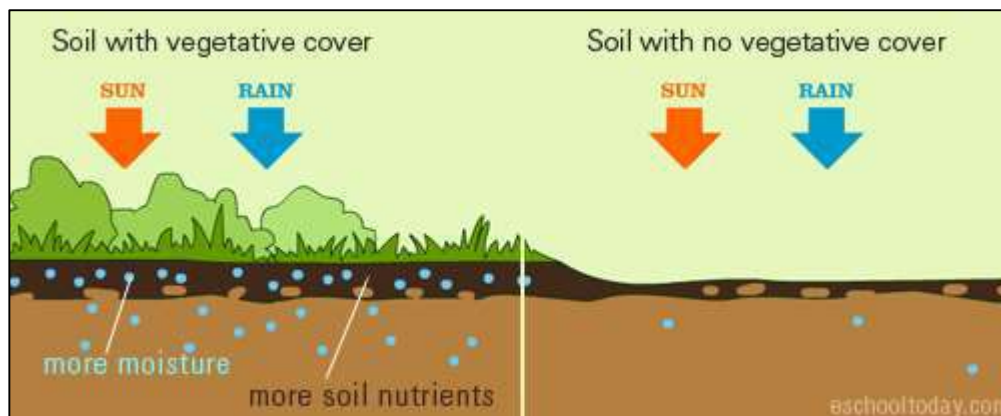
- **Role of precipitation:** In areas that experience a lot of rainfall, water percolating down through soil tends to leach nutrients and organic matter out of the upper layers, unless modified by other soil components like plant roots.
  - E.g. the soils underlying tropical rain forests tend to be nutrient-poor because of intensive leaching due to heavy rains; most of the nutrients are stored in the lush vegetation itself.

- Conversely, in arid regions with little annual precipitation, high rates of evaporation encourage the accumulation of salts in the soil.

- **Role of temperature:** Solar energy, usually expressed as temperature, controls the form of water falling onto the soil surface as well as in the soil. Also, it increases the rate of reactions, such as chemical reactions, evapotranspiration and biological processes. Wide fluctuations in temperature, especially in the presence of water cause shrinking and swelling, frost action and general weathering in soils.
  - E.g. Laterite soils are found in alternate wet and dry climate.
  - In Rajasthan, both granite and sandstone give birth to sandy soil irrespective of parent rock because of high temperature and wind erosion.

**3. Biota (Flora, Fauna and Microorganisms):** Biota, in conjunction with climate, modifies parent material to produce soil.

- The kind and amount of plants and animals that exist bring organic matter into the soil system as well as nutrient elements. This has a great effect on the kind of soil that will form.
  - E.g. Soils formed under trees are greatly different from soils formed under grass even though other soil-forming factors are similar.
- The roots of plants also hold the soils and protect them from wind and water erosion. They shelter the soils from the sun and other environmental conditions, helping the soils to retain the needed moisture for chemical and biological reactions.

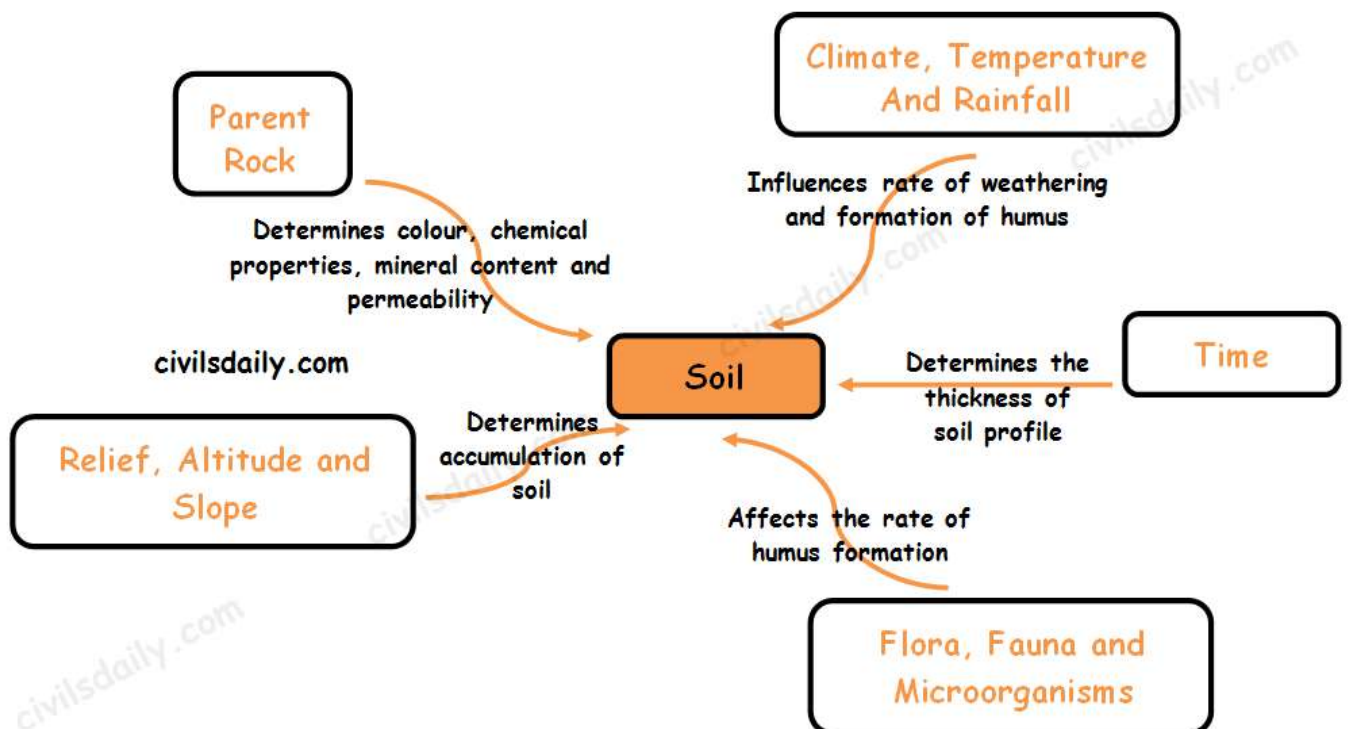


**5. Topography (Relief, Altitude and Slope):** Topography is often considered a passive factor modifying the effects of climate.

Topography redistributes the water reaching the soil surface. Runoff from uplands creates wetter conditions on the lowlands, in some cases saline sloughs or organic soils. Thus, as a redistributor of the climate features, topography affects soil processes, soil distribution and the type of vegetation at the site.



**6. Time:** Soils can take many years to form. Younger soils have some characteristics from their parent material, but as they age, the addition of organic matter, exposure to moisture and other environmental factors may change its features. With time, they settle and are buried deeper below the surface, taking time to transform. Eventually, they may change from one soil type to another.



**Note:** The above factors are not mutually exclusive but interdependent. For example, the kind of vegetation found at any one location on the earth's surface is dependent on climate, parent material, topography, time and, in fact, soil. It is obvious that numerous combinations of the factors are possible. This leads to many different kinds of soils, each representing a certain combination of the factors of soil formation.