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**SOIL FORMATION PROCESS AND FACTORS**

The soil formation process depends upon the presence of new soil material which is either acquired by denudation or deposition. Denudation is the abrasion of present rock material by the action of ice, water or wind. Deposition is the accumulation of new materials that have been eroded from another place such as river gravels or blown gravel or the creation of new rocks due to volcanic action or the uplift of the ocean. So, these two actions are responsible for availing new parent materials that begin the process of soil formation. Examples of new parent materials include rocks, loess, gravel, alluvium, scree, and sand. Soils then begin to form from these materials through the process of weathering together with other chemical and physical processes as outlined below.

**Process of Soil Formation**

Accumulation of materials

Materials are added to the soil such as organic matter and decomposing materials or new mineral materials deposited by the forces of ice, water or wind and they accumulate over time. This happens in the top layer of the soil. In poorly drained soils, the organic materials accumulate since water-logging prevents it from being oxidized or broken down by soil organisms.

In well drained soils, the materials accumulate when they are held up by the root systems. Depositions by the forces of wind, water or ice equally contribute to the accumulation of new materials. Some plants with the help of bacteria fix atmospheric nitrogen and ammonia compounds into the soil as nitrates.

Leaching and losses

Through the movement of water, wind, ice or the uptake of the accumulated materials by plants, the new particles including clay, organic matter, clay, silt or other chemical compounds are leached and eroded away or taken up from the soil by plants. As a result, the physical and chemical compositions of the new accumulated materials together with the soil parent material are altered. A prime example is the leaching out of some carbonates, magnesium and other minerals.

Transformation and illuviation

Here the soil particles held in the suspension after the leaching such as clay are transformed after which they accumulate. Transformation is the chemical weathering of silt, sand, and the formation of clay minerals as well as the change of organic materials into decay resistant organic matter. After, the clay and other accumulated materials are washed from the upper horizons and deposited in the lower horizons. The plants and animals are also responsible for transformation of the soil by physically and chemically breaking down the materials. The soil begins to take shape on its own through transformation, which improves natural drainage and nutrient composition.

Podsolisation and translocations

Podsolisation takes place when strong acidic solutions breakdown the clay minerals. Accordingly, aluminium, silica and iron form complex materials together with organic compounds in the soil. These materials and the other accumulations are translocated within the profile and/or between the horizons. After a relatively extended time, the movements of the accumulated mineral precipitate such as iron oxides minerals are responsible for the reddish and brownish colour of the different soil horizons.

The same applies to the alterations in structure, texture, and other mineral compositions. The soil horizons are then cemented by the carbonate, iron, and silica minerals. For instance, sandy soils are normally cemented by iron. Here, the soil drainage and air space will depend on the resultant soil type and the compaction and cementation process.

**Factors That Affect Soil Formation**

Time

Soil formation takes several hundreds to thousands of years to undergo significant changes and their eventual formation. Most of the soils of the world have taken more than 10,000 years to form the current state of soils. What’s more, is that the soils within this age bracket are apparently still young as they present weak soil horizon development and slight alteration of parent material.

Parental Material (PM)

Parental materials are the unconsolidated organic deposits and minerals in

which soils are developing. For this reason, parental material determines the mineralogical composition and widely contributes to the chemical and physical characteristics of the soil. The type of parental material also determines the rate at which soil forming processes occurs.

The influence of parental material is very evident in so many regions across the world regarding soil formation. For instance, different places have different soils based on the parent materials such as marine area peaty soils due to the marine organic deposits and flood plain clay soils due to alluvial deposits.

Accordingly, the complexity of soil patterns, texture, composition, and color in different areas highly depends on the physical and chemical compositions of the parent materials. Majority of loamy soil, for instance, forms as a result of thin deposits of fine grained materials that have been mixed with organic materials and other underlying materials through natural process.

Climate

Climate especially precipitation, temperature and frost action have a fundamental influence on the soil formation process that takes place within any given location. The prevailing climatic conditions highly determine the nature of weathering process that will take place and the rates of physical and chemical processes. Climate directly has an effect on the kind of vegetation in an area which in turn will affect the soil formation processes related to root penetration and vegetation cover.

The accumulation and decay of organic matter also depends on humidity and temperature. Rainfall leaches away soluble materials and iron-rich minerals from the upper soil horizons into the lower ones and evaporation brings about the accumulation of salt compounds in the surface horizons. Cold winter temperatures give room for frost action which physically disintegrates the rocks into fragments.

Topography and relief

Topography is the configuration of a land surface and the relations among its man-made and natural features. Typically, it is the shape of the land surface and its position as well as slope on the landscape. So, these characteristics all together highly determine the types of soils formed within a region.

In most regions, soils formed from similar parent materials under the same climatic conditions present differences due to their position on the landscape. The differences are primarily because of varying drainage conditions owed to the depth of the water table or surface runoff. Soils formed on sloping areas and higher elevations are by and large excessively drained.

Soil profiles in areas that generally have groundwater depth of more than 6 feet commonly have bright coloured or dark brown to yellowish brown soil profiles. In poorly drained soils, where elevations are very high thus translating to lower water table, most of the soil profiles are characteristically dark-coloured and rich in organic matter.

Organisms (living things including man, plants and animals)

All living organisms play an active role in the soil formation processes. Organisms including fungi, bacteria, animals, humans, and vegetations are the major determinants and they impact on the physical and chemical environments of the soils. In forest areas, the soils are predominantly composed of the mineral content element of leaves and branches of the forest vegetation.

Soil profiles in hardwood areas are mostly alkali as they take up magnesium, calcium, and potassium from the forest branches and trees that are used in the development of organic litter. Soil profiles in conifer tree areas, on the other hand, tend to be more acidic as the alkali minerals are more susceptible to leaching since they are absorbed by the conifers due to the fact that they have low base concentrations.

Some types of micro-organisms encourage acidic conditions which change the soils chemistry and eventually determine the kind of soil formation process that occur. Microbial activities also decompose organic matter and recycle them in the soil. Larger animals including burrowing animals and earthworms mix the soil and alter its physical characteristics.

This makes the soils more permeable to water and air thus enhancing the soil structure. Man’s activates have as well made tremendous changes to the natural soils. Through cultivation, construction, and addition of fertilizer and lime has altered the physical and chemical properties of the soil. Filling, mining, and artificial drainage have altered the natural soil environments thereby negatively and positively affecting the process of soil formation.