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| **How do parent materials, time, climate, biota, and topography influence the formation and thus the characteristics of soil?** |
| **Parent Material**: The parent material has a strong effect on the type of soil developed as well as the rate at which development takes place. While the parent bedrock determines what kind of minerals a soil contains, the proportion of minerals in a soil and the parent bedrock may not be the same. Differences may occur as the result of chemical weathering. The hardness of parent rock also determines the length of time for the soil to form. |
| **Time**: Time is required for horizon formation. The longer a soil surface has been exposed to soil forming agents like rain and growing plants, the greater the development of the soil profile. Soils in recent alluvial (material deposited by rivers) or windblown materials or soils on steep slopes where erosion has been active may show very little horizon development.Soils on older, stable surfaces generally have well defined horizons because the rate of soil formation has exceeded the rate of geologic erosion or deposition. As soils age, many original minerals are destroyed and many new ones are formed. Soils become more leached, more acid, and more clayey. In many well drained soils, the B horizons tend to become redder with time. |
| **Climate**: Climate is a major factor in determining the kind of plant and animal life on and in the soil. It determines the amount of water available for weathering minerals, transporting the minerals and releasing elements. Climate, through its influence on soil temperature, determines the rate of chemical weathering.Warm, moist climates encourage rapid plant growth and thus high organic matter production. The opposite is true for cold, dry climates. Organic matter decomposition is also accelerated in warm, moist climates. Under the control of climate freezing, thawing, wetting, and drying break parent material apart (mechanical weathering).Rainfall causes leaching. Rain dissolves some minerals, such as carbonates, and transports them deeper into the soil. Some acid soils have developed from parent materials that originally contained limestone. Rainfall can also be acid, especially downwind from industrial processes.  |
| **Biota** (plants, animals, insects, bacteria, & fungi): Plants affect soil development by supplying upper layers with organic matter, recycling nutrients from lower to upper layers, and helping to prevent erosion. In general, deep rooted plants contribute more to soil development than shallow rooted plants because the passages they create allow greater water movement, which in turn aids in leaching. Leaves, twigs, and bark from large plants fall onto the soil and are broken down by fungi, bacteria, insects, earthworms, and burrowing animals. These organisms eat and break down organic matter releasing plant nutrients. Some change certain elements, such as sulfur and nitrogen, into usable forms for plants.Microscopic organisms and the humus they produce act as a kind of glue to hold soil particles together in aggregates. Well-aggregated soil is ideal for providing the right combination of air and water to plant roots.Animals living in the soil affect decomposition of waste materials and how soil materials will be moved around in the soil profile. |
| **Topography**: Topography (the angle and length of the slope) influences the movement of water in the landscape and soil temperature. Soils positioned higher in the landscape are generally more well-drained than those in lower landscape positions, due to the movement of water downslope to lower lying areas. This movement of water also influence erosional processes that result in soils on steep slopes being thin or shallow, whereas soils on level or gently sloping land have little runoff, increase water filtration, faster plant growth leading to more organic matter, and less erosion. As a result, they tend to be deeper, darker, contain more horizons, and faster development. Additionally, aspect of a landscape position has a strong influence on soil temperature. South-facing slopes in the northern hemisphere are generally warmer, less moist, and contain lower amounts of soil organic matter than north-facing slopes. |