Soils and Climate

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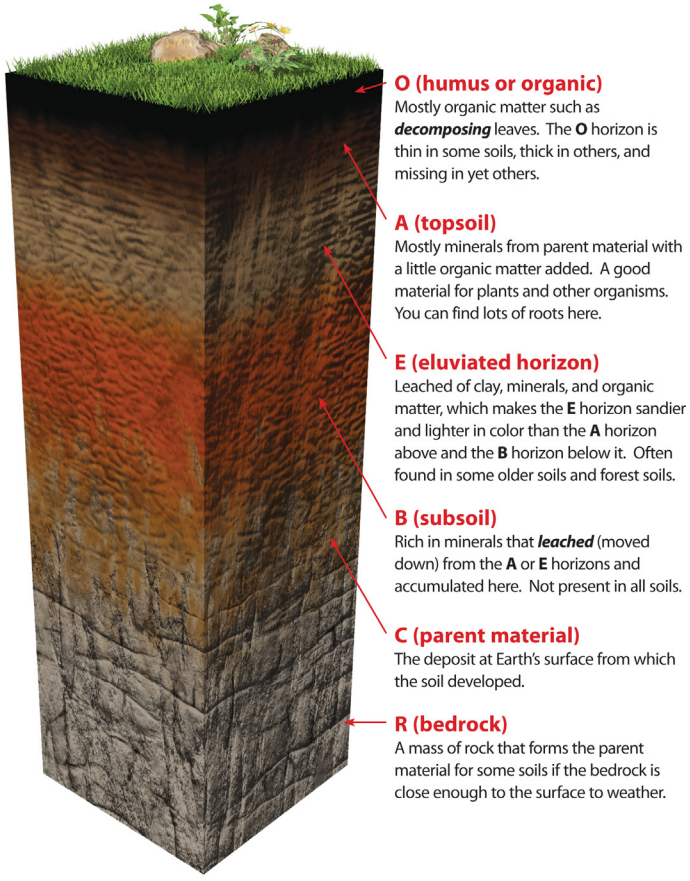
Climate Influences Soils

Climate refers to the temperature and moisture conditions of an area over time. Climate is the typical pattern of the area over the long term, but weather is the actual daily condition. Of interest, climate is one of the five soil forming factors and has a significant influence on the properties of soil. Soils in warmer or wetter climates are more developed than soils in cooler or drier climates. How developed a soil is can be determined from looking at the profile. A profile can be found by digging into the ground and looking at the different layers of soil, also known as horizons. Soils that are more developed have more horizons and deeper horizons than soils that are less developed. Wet conditions favor **leaching**, or moving deeper with water, of clay and other minerals so that E and B horizons develop. Warm conditions promote the chemical and biological reactions that develop parent material into soil.



In a dry climate, the A horizon would be very thin because there are few plants to become organic matter, and the C horizon would still be present, with nutrients still locked into minerals, because there is not enough water to promote weathering and leaching of minerals, or development of a B horizon. In a tropical environment, the soil can become so leached that there are very few nutrients available from soil minerals. These are some examples of why the soil in certain climates is not as desirable for agriculture, homes, or other uses.

While weather is a short-term part of climate, certain weather cycles can still affect soil. For example, soil can be dried out and rearranged during droughty or windy weather. As the soil is dried out, plant growth is reduced, which reduces the stability of the surface layer and allows more erosion. An extreme example of this is the process of **desertification.** Soils that are losing stable plant communities become unstable themselves and begin to shift like desert sand dunes. Worldwide, more than 50% of land degradation can be attributed to desertification.

It is important to implement land management practices that reduce the likelihood of desertification. Some examples include:

- reducing the number of animals grazing in areas with low vegetation,
- moving animals to new areas more frequently,
- using conservation tillage and no-till practices,
- using low intensity and high diversity crop rotations,
- maintaining perennial vegetation,
- using irrigation properly to increase ground cover, and
- using selective or staggered tree harvest techniques rather than clear-cutting.

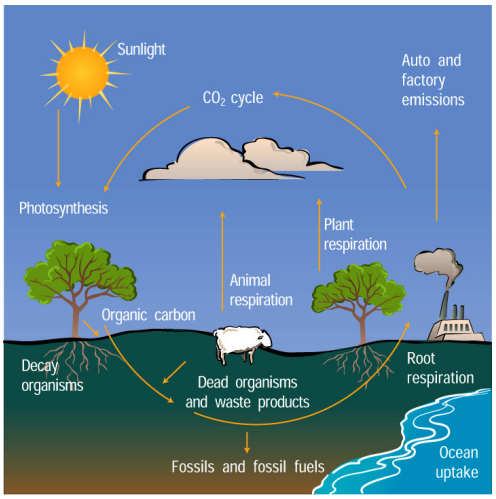
Soils Can Influence Climate

Not only does climate influence soil, but soil can influence climate. Global climate change is a current scientific concern. Increases of greenhouses gases, such as carbon dioxide and methane, are contributors to climate change. Soil is an important part of the carbon cycle, and changes in soil management practices can reduce emissions of carbon-containing gases from soil. Plants use carbon dioxide from the air. When plants die, soil microorganisms decompose the plants and return the carbon dioxide to the air. Soil conditions with slower decomposition can reduce the carbon returned to the air. Some examples of these soil conditions are wetlands, which don't have enough oxygen for efficient decomposition, and undisturbed lands, where the plants and roots live for many years. Reducing disturbance on managed lands by practicing no-till farming, harvesting forests less frequently, and leaving green space in urban areas can reduce carbon emissions from those soils as well, as sthe carbon is then not relased back into the atomosphere.

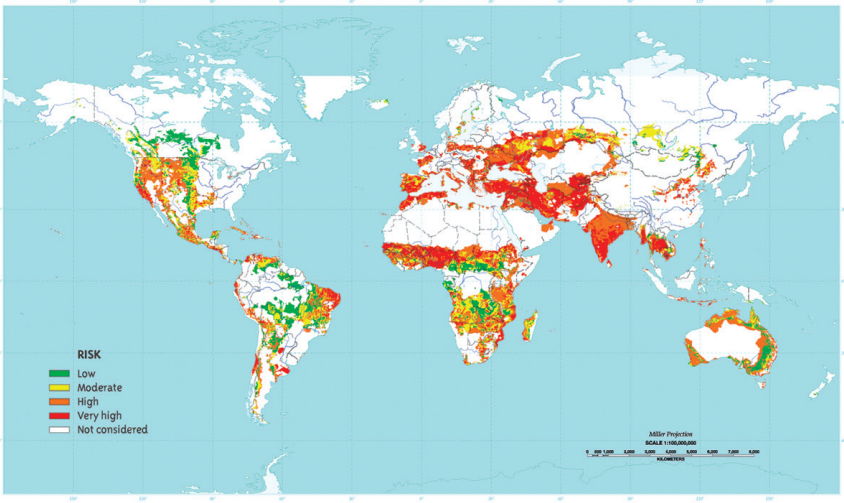
Soil can also influence climate on a smaller scale. Soils that are wetter or denser hold heat and stabilize the surroundings from temperature changes more so than drier, looser soils. The temperature in deserts may increase by more than 60°F during the course of a day. Natural variation in soil properties can lead to areas with better moisture and heat storage than their surroundings. Cities, where there are fewer plants and less exposed soil, often experience what is called a "heat island" which means that the city is warmer than other nearby areas. The difference in temperature in these heat islands can be up to 5 degrees during the day and up to 20 degrees at night. These microclimates can have different plant and animal communities than the surroundings and are important to creating ecological niches.

-Recap-

Climate has an important role in soil formation. Observing soils and soil profiles can give clues to past climates and weather cycles. Some climates have soils that are not as deep or fertile and require special management for preservation. Soil is an important part of the global carbon cycle. Different land management practices result in different amounts of carbon being released to the atmosphere. Understanding this may allow us to manage for a reduction in greenhouse gas emissions from soil and therefore manage soil's effect on climate.



Soil is an important part of the carbon cycle. NCAR/UCAR



Areas of the world most vulnerable to human-induced desertification. NRCS

Author: Meghan Sindelar