Soil

Learning Goals

1. Why is soil important?
2. Even though soil can be made, why is it considered a non-renewable resource?
3. Name and describe the different layers of soil?

What is soil?

Soil is considered the 1 m thick biogeochemically altered sediment that has different properties than its rock source. (Amundson et al., 2015)

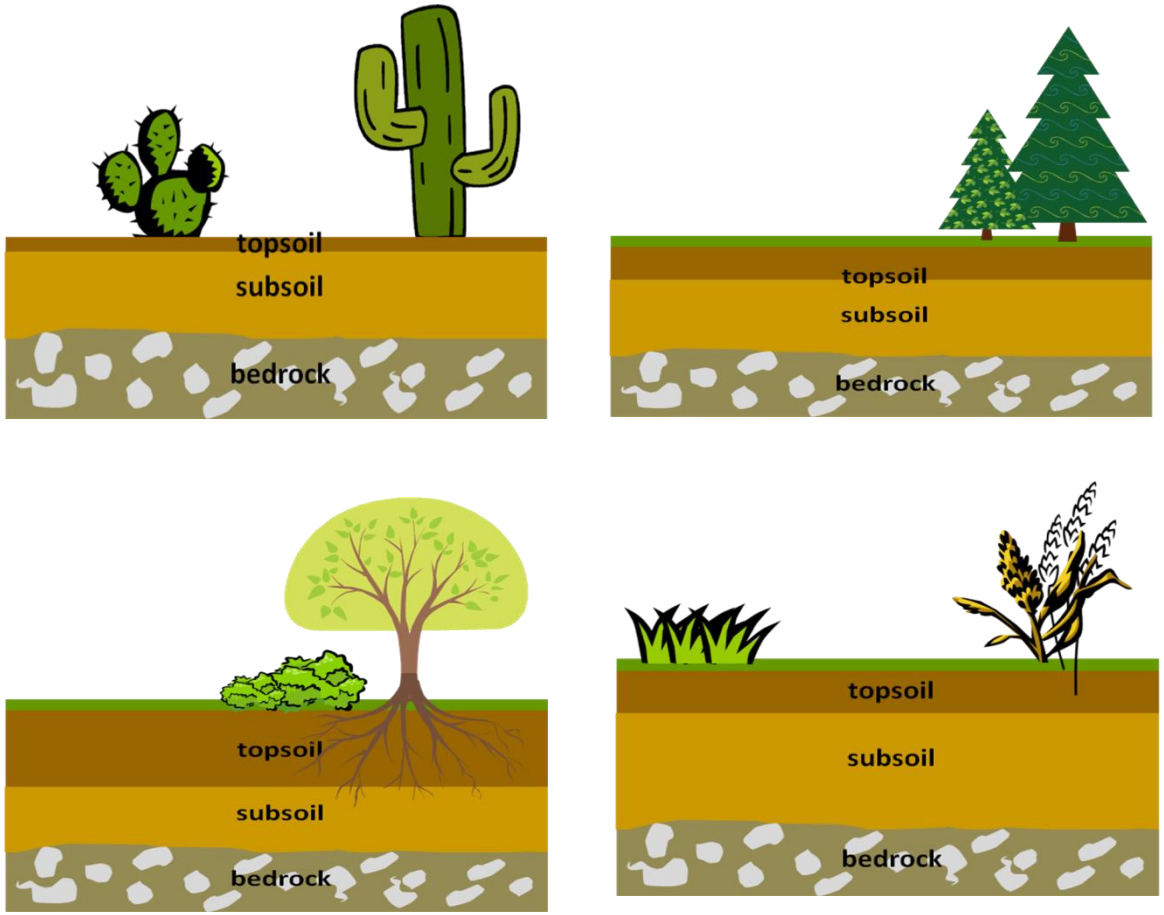
What does soil do?

Soil has the ability to do many things.

1. It is a no-brainer but, soil can grow plants— 90% of the world food source occurs because of soil. (Amundson et al, 2015)
2. Soil is believed to hold 65% of the world's fresh water resources. (Amundson et al, 2015)
3. Soil has the ability to remove or reduce toxins. (Amundson et al, 2015)
4. The biodiversity of microbial, plants and animal life in soil is important to controlling climate change and allows it to act as a carbon sink). Soil is also important for other nutrient cycles (N, P, K) on the planet. (Amundson et al, 2015)

Are all soils made equal?

- Different ecosystems have soil layers of different thicknesses
- Soils that have the most plant diversity, tend to have the thickest topsoil layers (Kopstik, Kopstik and Livantsova, 1999)



Who cares about dirt?

- Dirt is quickly becoming an endangered species. The UN declared 2015 the year of the soil because of its importance of a resource on the planet (Howgego, 2015)
- We are using soil faster than it can be replaced making a limited renewable resources. Soil is lost to erosion and nutrient depletion.
- Therefore the cost of food will increase and the ability to get food will decrease.
- Soil erosion is reducing the ability of soil to absorb CO_2 from the atmosphere. (Amundson et al. 2015)

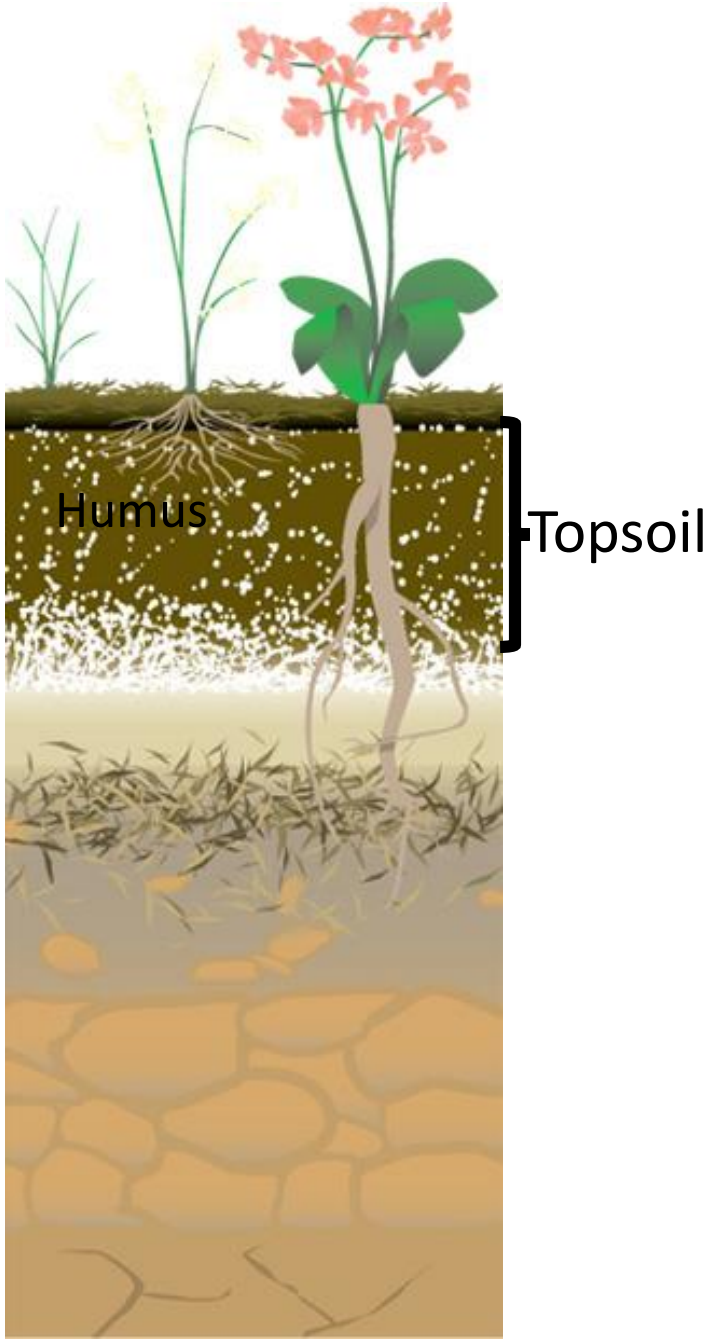
What is soil made of?

There are four Layers of Soil

1. Litter (layer of debris on top of the ground)
2. Topsoil (The layer on TOP)
3. Subsoil (The prefix SUB means under)
4. Bedrock (It's hard as rock down there!)

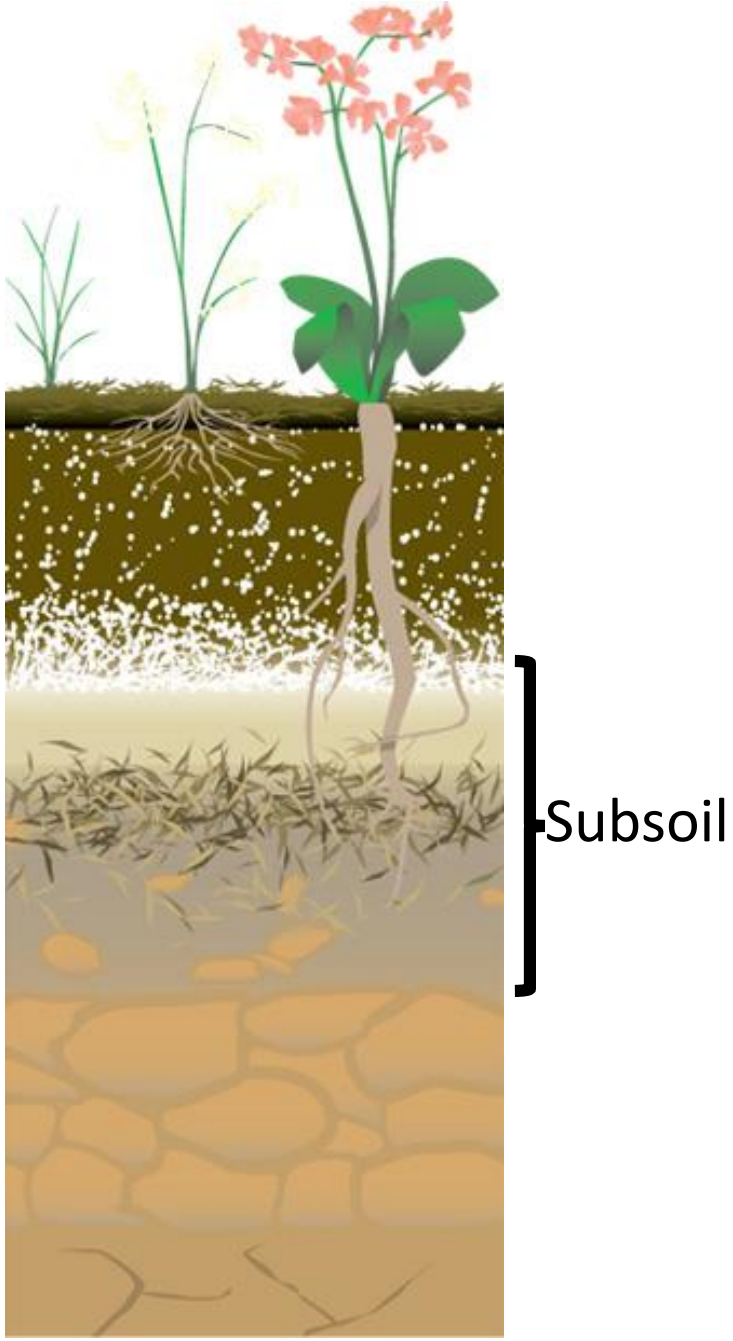
Soil has many layers.

Litter: The top layer of soil that keeps the temperature from changing too much and prevents water from evaporating.

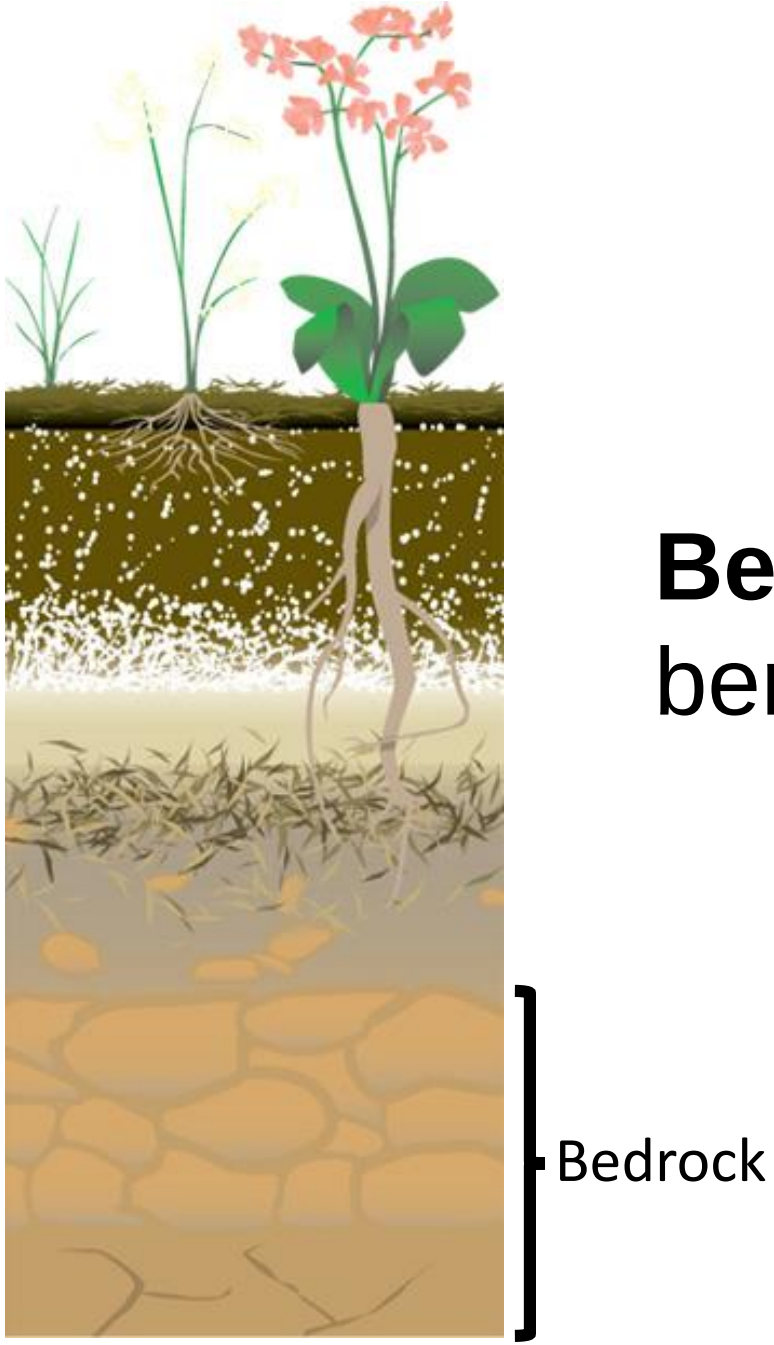


Topsoil: is made up of small rock particles and decaying plant or animal matter.

Humus: decaying plant and animal matter in soil that gives topsoil its dark colour. It is rich in nutrient, oxygen and water.



Subsoil: A layer of soil that has more stones and only small amounts of humus. Subsoil is lighter than topsoil, but is rich in minerals



Bedrock: A layer of rock beneath the soil

There are five parts of soil:

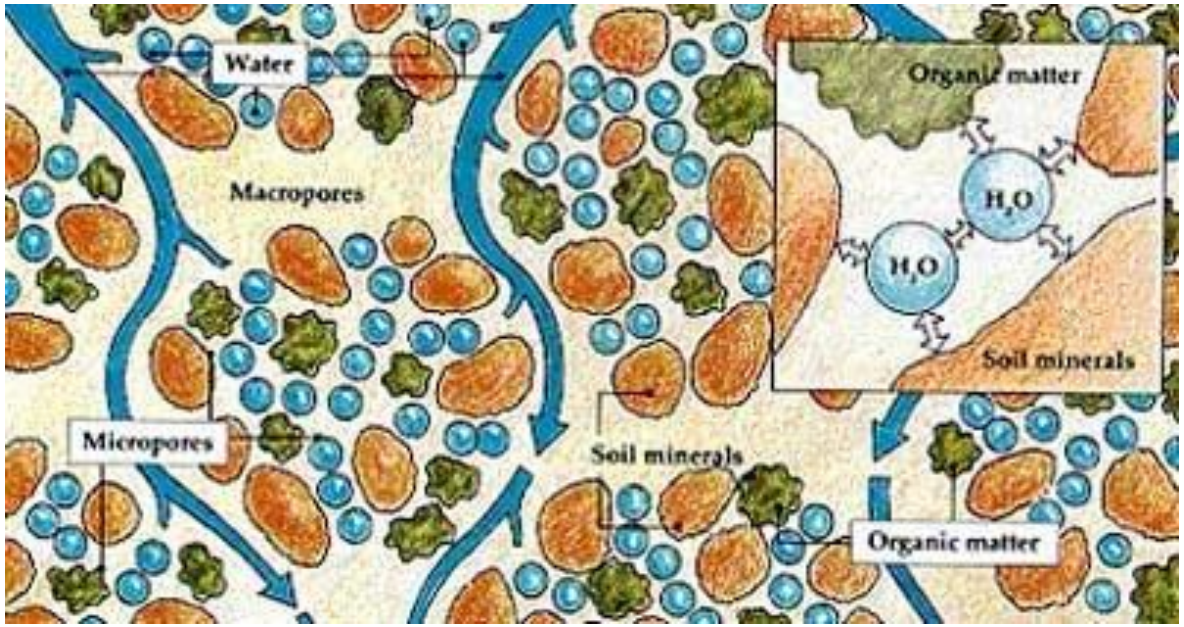
- 1. Rock
- 2. Sand
- 3. Silt
- 4. Clay
- 5. Humus

- Can you match each type of soil to its pictu

What are the components of topsoil?

There are several components of topsoil (DeGomez, Kolb and Kleinman, 2015):

1. Minerals **which** come in the form of sand, silt and clay. (45-49%)
2. Water (5-50%)
3. Gas-like carbon dioxide and nitrogen
4. Organic matter (1-5%)– decaying plant, animal and microbial organisms.
5. Micro-organisms (1%)



Sand

- Sand is tiny grains of worn down rock approximately 0.05 – 2.00 mm in diameter.
- It doesn’t hold water or have many nutrients.

Silt

Silt is very small, broken pieces of rock approximately 0.002 - 0.05 mm in diameter.

It is powdery when dry.

Sand ----------Silt----------Clay

(smaller particles) (larger particles)

Clay

Clay is made of very small particles <

0.002 mm in diameter

Clay holds water well. It is sticky and can be shaped when it is wet. But, it is very hard when dry.

Clay has many nutrients.

Organic Matter

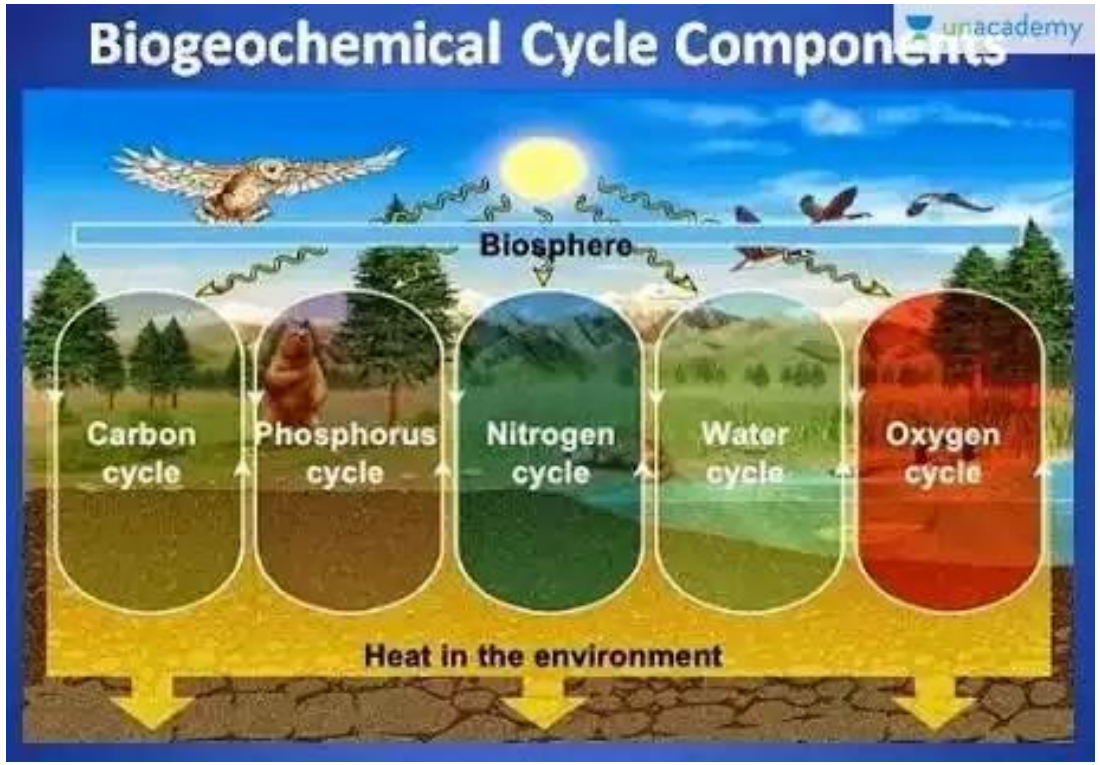
Organic matter also known as humus is made of leaves, twigs, small animals, or other decayed substances.

Humus adds many nutrients to the soil.

Humus is in the topsoil.

Gases and Water

- Gases and water are recycled from the atmosphere through the soil. Nitrogen, carbon, phosphorus, oxygen and potassium cycles its nutrients through the soil keeping the atmospheric gases in balance.
- The soil and its health is a major component of preventing climate change. (Amundson, 2015)



Micro-organisms

The type of micro-organisms (bacteria and fungi) that live in the soil determine the types of plants that can grow in that soil. (Le Page, 2016)

The biodiversity of these micro-organisms may be a source of new types of antimicrobial drugs (Sarchet, 2015)

How is soil is formed and how long does it take?

Soil is built from the bottom to the top.

1. Rain, wind, frost and snow break up the bedrock.
2. Lichen grows on the surface of rock and secretes materials that breaks it up
3. As lichen dies, it adds a layer of humus to the rock.

How is soil is formed and how long does it take?

4. Plants begin to grow and the decaying matter from these plants form the topsoil
5. Water that is found in the layers of the Earth's crust. Groundwater helps to break up bedrock (https://www.the-compost-gardener.com/soil.html)

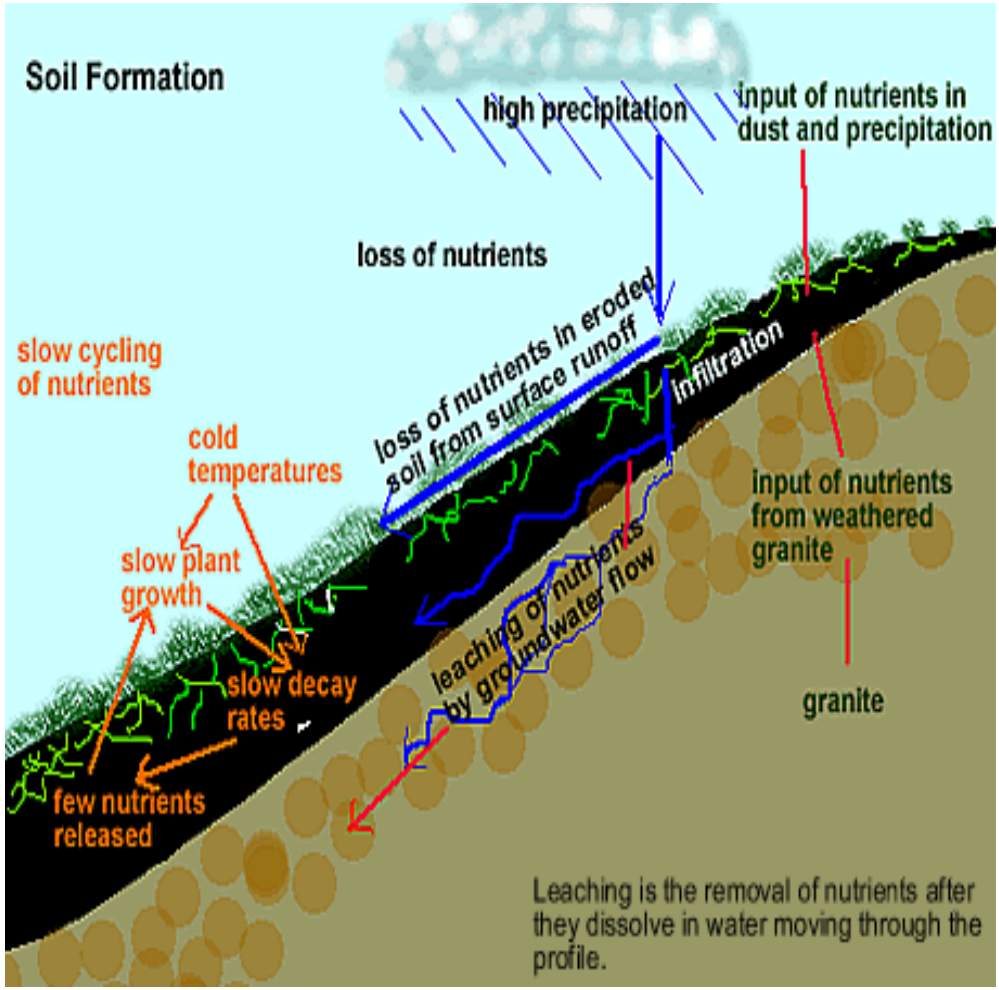
It takes approximately 200-400 years to make 1 cm of soil and approximately 3000 years to make soil fertile (http://www.eniscuola.net/en/argomento/soil/soil-formation/how-long-does-it-take-to-form/)

Human activity and soil

Leaching: water moving downward dissolves and removes minerals and organic material from the top soil. Leaching makes it difficult for plants to grow.

Acid rain is caused by burning fossil fuels.

Acid rain increases leaching nutrients from soil and makes the soil less fertile.



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References

n.d.) “What is Soil?”retrieved from https://www.the-compost-gardener.com/soil.html

(n.d.) “How long does it take to form?” retrieved from http://www.eniscuola.net/en/argomento/soil/soil-formation/how-long-does-it-take-to-form/

Amundson, R., Berhe, A.A., Hopmans, J.W., Olson, C., Sztein, A.E., Sparks, D.L. (2015) “Soil and human security in the 21st century” Science 348:1261071-1-1261071-6

DeGomez, T., Kolb, P., Kleinman, S. (2015) “Basic Soil Components” eXtension Retrieved from http://articles.extension.org/pages/54401/basic-soil-components

Howgego, J (2015) "Endangered earth: The secret battle to save our soils” The New Scientist 7 October, 2015 Retrieved from https://www.newscientist.com/article/mg22830423-300-endangered-earth-the-secret-battle-to-save-our-soils/

Kopstik, G.N., Kopstik, S.V., Livantsova, S. Y. (1999) “Assessment of Soil Quality for Biodiversity Conservation in Boreal Forests” Stott, D.E., Mohtar, R.H., Steinhart, G.C. (eds) Sustaining the Global Farm. 627-634

LePage, M. (2016) “Soil organisms alone can determine which plants grow where” The New Scientist 11 July 2016. Retrieved from https://www.newscientist.com/article/2096740-soil-organisms-alone-can-determine-which-plants-grow-where/

Sarchet, P. (2015) “Citizen scientists sift soil for new antibiotics” The New Scientist 20 January 2015 Retrieved from https://www.newscientist.com/article/dn26825-citizen-scientists-sift-soil-for-new-antibiotics/