

Soil Biodiversity

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Soil biodiversity is amazing!

For example, in a 1 m by 1 m piece of garden soil you might find...

- 100 species of worms (earthworms, nematodes, enchytraeids)
- 100 species of mites and collembola
- hundreds, even thousands, of species of bacteria and fungi)

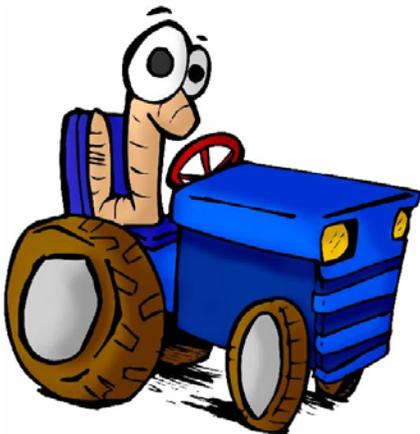


For every type of organism present, there will be many different species. The variety and numbers of creatures that live in the soil is mind-boggling!

Did you know...?

All animals that live in the soil have a job to do...

1. Building soil structure
2. Nutrient cycling
3. Protecting plants against diseases and pests



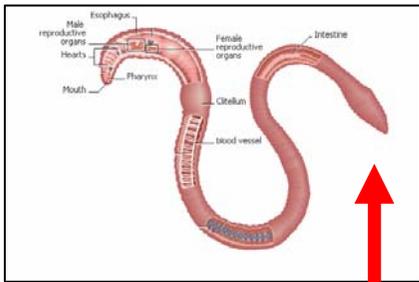
For example, you can find all these different species of collembola...



Earthworms

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- Earthworms range in size from several millimetres up to almost a metre in length!
- There are 28 species of earthworm in the UK



Earthworms eat plant remains and ingest soil organic matter in various stages of decomposition together with microorganisms associated with this material

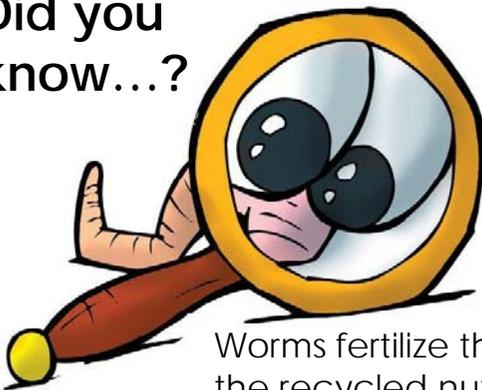
An earthworm's mouth is at the pointed end. Earthworms do not actually have any eyes, but can sense changes in light with their body



Earthworms create tunnels by burrowing. These tunnels help improve soil structure which in turn helps plant growth by aerating the soil, and drainage of water

Earthworms are very helpful creatures to have in the soil!

Did you know...?



Worms fertilize the soil with their castings (poo), which contain the recycled nutrients from the food they eat



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Foundations

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Why don't trees fall over?

They stand so tall, they sway in high wind. So why don't they blow over...?!

It's all in the soil!!

Just like you can't build a house without foundations, a plant cannot stay upright without similar support.



Soil allows roots to grow through it

As plants grow up and out, the roots grow down and through. Different plants have different root systems – including "tap", "heart" and "flat" roots.



Soil surrounds roots and prevents them being pulled out of the ground.

One of the major roles of plant roots is to anchor the plant firmly in the soil, and prevent it being blown over.



Careful!!

This doesn't always happen. Some bigger trees can be unstable in bad weather.

So how does soil keep them upright?

- Soil provides an **anchorage** for trees and other plants that grow above ground.
- Roots grow down and through soil throughout the life of a plant – they are the plant's foundation!
- Without the possibility of a root network a plant couldn't grow tall and strong



Hungry Plants

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Where do plants go when they're hungry?

Nowhere. They can't move so the food comes to them...



It's all in the soil!!

Plants need nutrients just like humans do, the sun is not enough by itself. These nutrients are taken in from the soil by the roots of growing plants and carried through the roots into the growing plant above ground.

Where does plant food come from?

- Rock breakdown
- Rotting of organic matter (plants and animal bits)

In nature, nutrients are constantly recycling between soils and plants. Dead plants fall to the ground and are broken down to release nutrients, which then take part in the next cycle of growth.

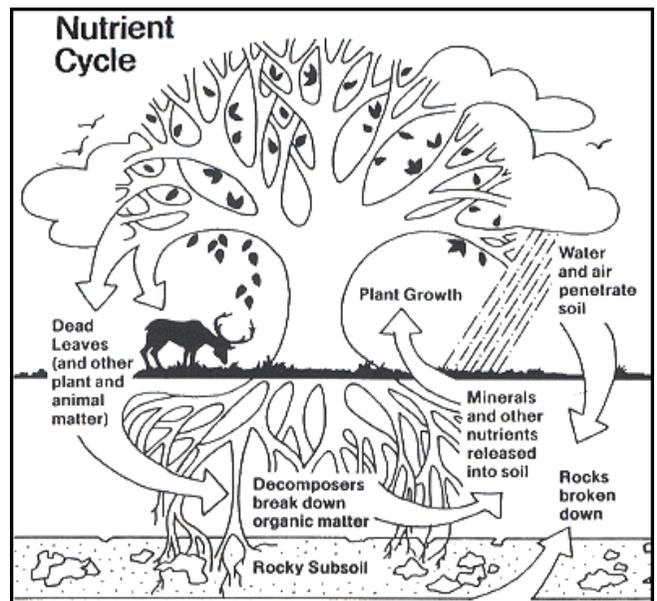
In agriculture, when the crop is harvested, most of the nutrients in the plants are also removed from the field and important recycling of nutrients is not possible. The farmer must therefore add extra nutrients to the soil.

What do plants like to eat?

There are 18 nutrients in soil that are important to plants. Like us, plants need a balanced diet and without all the nutrients they can't grow properly and may die.

Some lack **macro-nutrients** (including nitrogen, calcium, magnesium and potassium).

Some lack **micro-nutrients** (including iron, zinc, copper, and boron).



It's the "circle of life"!





Organisms that live in soil breathe in oxygen and breathe out carbon dioxide and water vapour...

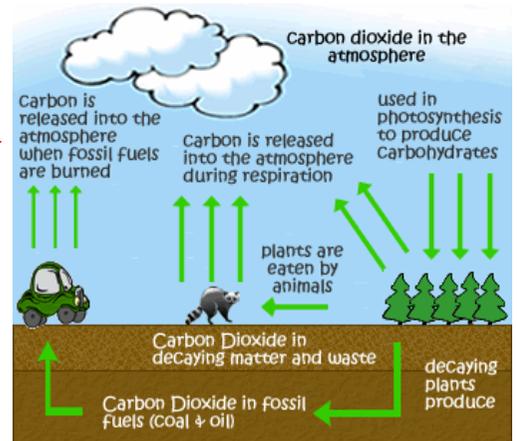


...just like us!



Soil plays a critical role in the carbon cycle...

World soils contain twice as much carbon than there is in the whole of the atmosphere and more than twice that in all the living vegetation in the world!



<http://www.realtrees4kids.org/sixeight/cycles.htm>

Did you know...?

The presence of carbon dioxide and water vapour can be demonstrated using the following 3 experiments...

Cobalt (II) chloride hydrate

Water vapour liberated by the soil organisms when in contact with Cobalt (II) chloride changes the colour from blue to pink



Lime water

Carbon dioxide liberated by the soil organisms when mixed with lime water forms a cloudy precipitate known as calcium carbonate

Copper (II) sulphate hydrate

Water vapour liberated by the soil organisms when in contact with Copper (II) sulphate changes the colour from white to blue





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What is soil made of?

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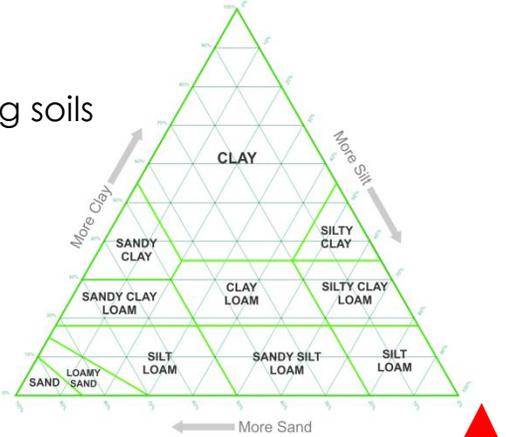
Soil is not just mud!

Sandy soils: These are light, generally free-draining soils but lose nutrients rapidly

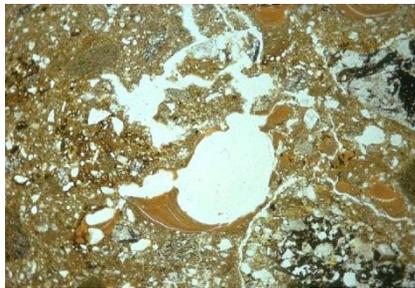
Clayey soils: These are heavy, difficult-to-work soils when wet. They hold on to both water and nutrients much more than sandy soils do

Silty soils: These tend to hold less water and nutrients than clay soils but more than sandy soils do

All mineral soils contain sand, silt and clay particles, but in varying proportions. A **standard texture triangle** is used to decide the soil type based on the proportions of the three sizes of these mineral constituents.



And there's more...!

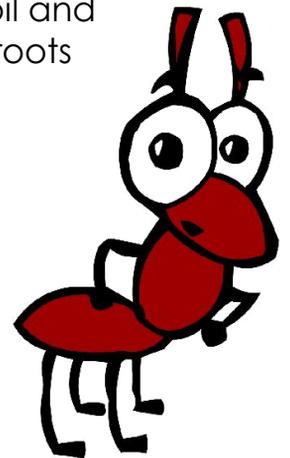


Organic matter: releases nutrients slowly as it rots and improves water holding capacity



Water: clings to soil particles and is taken up by plant roots

Air: fills gaps in soil and allows the plant roots and animals to 'breathe'



Animals: including insects, bacteria and earthworms – these help to break down dead materials

Soil means different things to different people, but we all need to look after it!





Soil pH

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What is pH ?

- pH is a measure of the acidity or basicity of a solution
- pH depends on the activity of hydrogen ions
- The pH of soils is usually between 3.5 and 8.5

How is pH measured?

- pH can be determined using a litmus paper
- Litmus is a water-soluble dye extracted from certain lichens



Litmus (pH indicator)	
below pH	above pH
4.5	8.3

Substance	pH
Hydrochloric Acid, 1M	0.1
Battery acid	0.5
Gastric acid	1.5 – 2.0
Lemon juice	2.4
Cola	2.5
Vinegar	2.9
Orange or apple juice	3.5
Beer	4.5
Acid Rain	<5.0
Coffee	5.0
Tea	5.5
Milk	6.5
Pure Water	7.0
Healthy human saliva	6.5 – 7.4
Blood	7.34 – 7.45
Sea water	8.0
Hand soap	9.0 – 10.0
Household ammonia	11.5
Bleach	12.5
Household lye	13.5
Caustic Soda	13.9

Did you know...?

The *Hydrangea macrophylla* works just like litmus paper as the soil pH determines the colour of the flowers. In **acidic** soils the flowers are blue...



but in **alkaline** soils, the flowers are pink!

Sources : Soil-Net.com/Wikipedia





Thirsty Plants

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Where do plants go when they're thirsty?

Nowhere actually. They can't move so they need to be able to reach water from where they are.

It's all in the soil!!

Water gets into soil from rain or snow. Plants produce roots that grow through soil as wide as possible so they can reach water even in dry weather.

How do the plants get the water?

Plant roots mainly take water in near the tips where there are lots of root hairs.

Getting the balance right

Too much water...

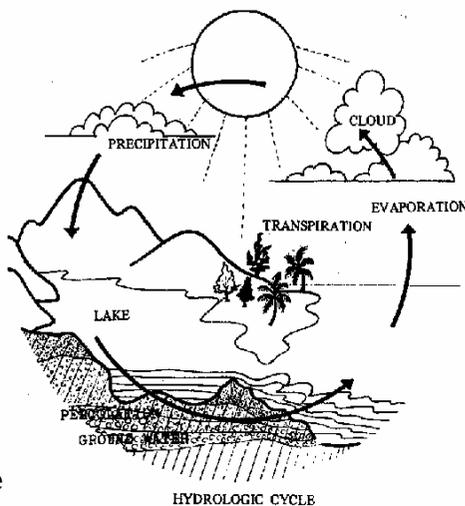


...requires **drainage**

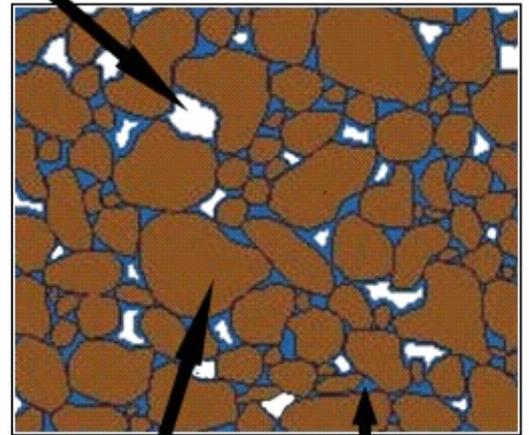
Too little water...



...requires **irrigation**



Air filled pore



Soil particles

Water filled pore

Soil can hold water like a sponge!

Water is held in soil in pores, with organic matter and around soil grains.

Different types of soil hold different amounts of water. Some hold too much, some hold too little, and some are just right (these are prized for gardening and food production)!





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