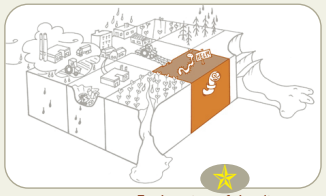
Loss of biodiversity

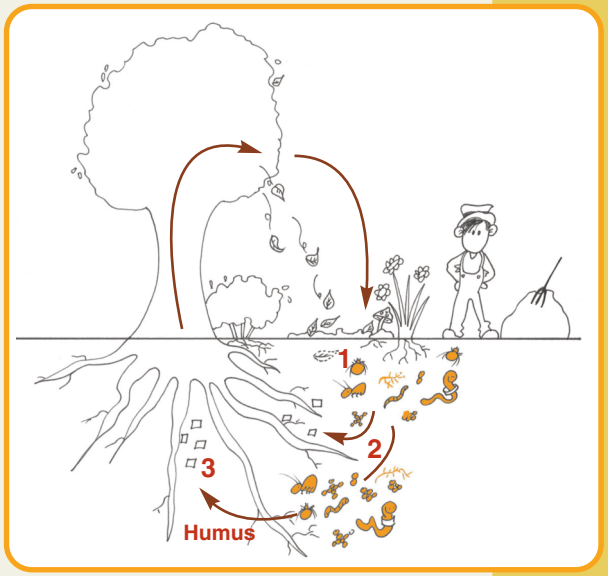
Soil life, a hidden treasure



Explanation of the diagram "The magic of soil" sheet

It has taken humans a long time to find out that soil is teeming with life: bacteria, fungi, algae, protozoans, spiders, mites, springtails, wood lice, centipedes, insect larvae, worms and more. A single spoonful of good quality earth can contain hundreds of millions of organisms of all sizes (most of them tiny or even microscopic) from thousands of different species. We still know relatively little about this soil life: it is actually estimated that we have identified only around 1% of bacteria living there!

Soil's good health is dependent on the activity of these organisms. Their actions make a vital contribution to the functioning of ecosystems and maintenance of a high-quality environment. Hence the importance of truly understanding the role played by these little workers and doing everything we can to protect them.



An essential role

1 When living organisms (plants and animals) die, the organic matter eventually returns to the soil.

Sheet 3 "Organic matter"

Soil organisms consume this matter, digest it and transform it into mineral elements which can be assimilated by plants.

2 The part of organic matter that is most difficult to decompose (lignin, tannins, etc.) is transformed into **humus** by these organisms and then, very slowly, into mineral elements.

Humus can remain in soil for several years. It is humus that is responsible for giving earth its smell and dark colour. It combines with fine particles of clay to give soil its good cohesion.

3 Mineral elements are assimilated by plants.

Four teams or nothing > Page 30
Soil organisms perform vital services > Page 31
Threats to soil life > Page 32
How can we protect soil life > Page 33

Four teams or nothing!

Soil organisms can be divided into **four main groups** : or four "teams", each of which fulfils a specific role.

1 Regulators

Spiders, mites, ants, etc.

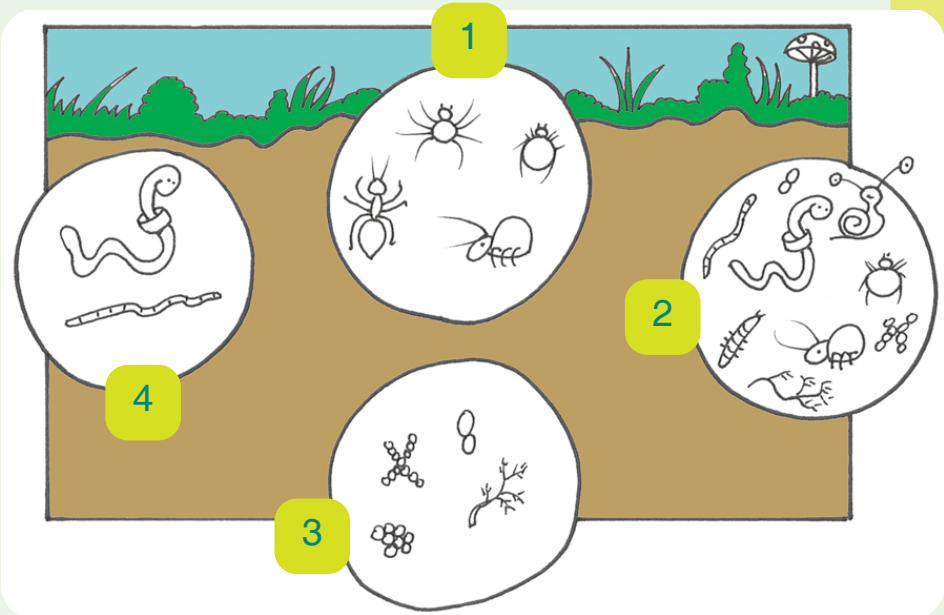
These are the predators. They eat or parasitize other soil organisms, animals or plants. This regulates these populations and stops them from proliferating.

2 Decomposers

Springtails, wood lice, centipedes, etc.

Decomposers cut, grind and fragment organic matter: dead animals and animal droppings, leaves, twigs, dead wood, etc. Their actions reduce organic matter to miniscule debris, small enough to be processed by the next team (the "transformers"). The decomposers are found mainly in the first few centimetres of soil, where dead organic matter builds up and decomposes (called "litter").

Sheet 3
"Organic matter"



In any soil,
it is essential that these four functions of
- **regulation**
- **decomposition**
- **mixing and**
- **transformation**

are performed,
and that workers from each team are represented.
Of course, the probability of these four functions being performed increases if soil contains a high number of different species...

3 Transformers

Bacteria, fungi, etc.

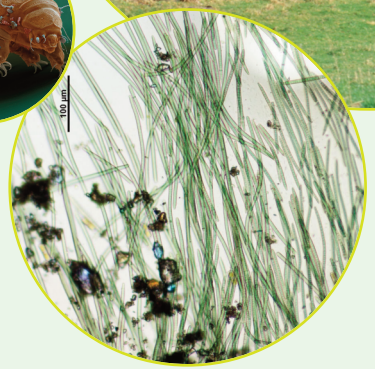
These consist mainly of microscopic bacteria and fungi which transform organic matter debris into mineral elements which can be assimilated by plants.

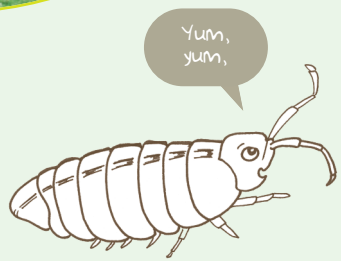
4 Mixers

Worms, moles, etc.

Some of the life forms in soil like to dig out tunnels! Their digging helps to stir the soil and this creates useful habitat for other organisms. These tunnels also encourage circulation of oxygen and water. But most importantly, the mixers' continuous activity binds organic matter to other soil components, thanks mainly to the binding agents contained in their droppings. **Earthworms** are the most efficient and important members of this team.

Soil organisms perform vital services





Protection against water runoff and erosion

By moving around in soil, earthworms make it more permeable to rain water. Their droppings also strengthen soil's structure. This makes soil less vulnerable to water runoff and erosion*.

Sheets 1 and 2 "Erosion" and "Sealing"

* water runoff: rain water flowing over the surface

* erosion : detaching of particles of soil by rain, wind or certain agricultural practices.

Direct and indirect prevention of pollution

Soil bacteria are capable of degrading certain pollutants and therefore make a direct contribution to combatting pollution.

Organisms' predatory activities and competition also help to maintain soil's balance. They prevent the proliferation of certain parasites or pests which damage crops (bacteria, fungi, etc.). This helps to reduce the use of synthetic pesticides.

Role in the carbon cycle and reduction of the greenhouse effect

Soil organisms play a role in the **carbon cycle** as their breathing releases CO_2 into the atmosphere. This CO_2 is captured by the leaves of plants, allowing them to produce their organic matter.

Intro sheet "Magic of soil"

However, some of the carbon found in the organic matter transformed by these micro-organisms remains in soil for several years in the form of humus. Consequently, this carbon is not released into the atmosphere. Soil workers therefore play a role in carbon storage and prevention of the greenhouse effect.

Sheet 3 "Organic matter"

Greater fertility for crops

Soil organisms recycle plant and animal organic matter into nutrients which can be assimilated by plants. They therefore have a positive effect on soil's production of healthy and abundant plants.

Threats to soil life!

The diversity of species found in soil ("biodiversity") of course depends on a wide range of factors - of human and natural origin - such as the type of soil, its acidity, porosity, etc.

Some human factors:

Non-replenishment of organic matter

In some cases, soil organic matter is not replenished: we systematically gather up dead leaves, remove hay and other crop residue rather than leaving things where they are. Over time, this results in a shortage of food, habitat and breeding sites for organisms and micro-organisms.

Sheets 3 and 2
"Organic matter"
and "Sealing"

Pollution

Soil can be polluted either locally or on a wider scale: this can be caused by accidental spillage of toxic substances, past or present industrial discharges, repeated use of pesticides, etc.

Sheets 5 and 6
"Local pollution"
and "Diffuse pollution"

Physical degradation (sealing, erosion, etc.)

Sealing – in other words, covering soil with impermeable materials such as asphalt and concrete–, or compressing it as a result of the movements of heavy agricultural, forestry or construction machinery, deprives soil organisms of oxygen, water and food. Erosion also carries away organic matter, taking with it organisms and micro-organisms.

Sheets 1, 2 and 8
"Erosion", "Sealing"
and "Compaction"

How can we protect soil life?

Nourish soil organisms by adding organic matter

Organic matter from plants must be returned to soil as far as possible, either by leaving this matter on the soil when it falls in autumn or by regularly replenishing it with a balanced compost*.

* compost : kind of vegetable mould obtained from decomposed organic waste

Sheet 3 "Organic matter"

Do not confuse organic matter with fertiliser!

Fertilisers provide plants with nutrients, but they do not nourish soil fauna. If used to excess and without due care, they can bring about an imbalance in soil and jeopardise its effective functioning. We should therefore look after soil and provide it with regular supplies of organic matter in the form of soil amendments (compost, manure, etc.) rather than trying to "stimulate" plants with fertilisers.

Sheet 3 "Organic matter"

Replace asphyxiating impermeable surfaces

Wherever possible, try to replace asphalt or concrete with permeable materials, or even better, with flowering plants, trees, hedges, or similar. Choose indigenous varieties rather than invasive exotic species to avoid detrimental effects on biodiversity.

Sheets 2 and 3
"Sealing"
and "Organic matter"

Combat erosion

It is better to avoid leaving soil bare: planting vegetation will help to stop soil drying out, as well as preventing the formation of hard crusts and erosion caused by rain. Plants' roots contribute to soil's stability and they provide a larder for soil fauna.

Sheets 1 and 3
"Erosion" and "Organic matter"

Reduce or eliminate synthetic pesticides

The active ingredients found in commercial pesticides (herbicides, fungicides, insecticides, acaricides, etc.) are very harmful to soil organisms, and those living above ground, including humans! Replacing these pesticides with environmentally friendly methods wherever possible will help to protect our soil's health.

Sheets 5 and 6
"Local pollution" and "Diffuse pollution"

Bibliography

General publications by the SPW – online information

Les Indicateurs Clés de l'Environnement Wallon 2012 (ICEW 2012), Direction de l'Etat Environnemental, SPW Éditions - DGARNE - DEMNA - DEE, 2013 (available for download in French, English and German)
http://etat.environnement.wallonie.be

Tableau de bord de l'environnement wallon 2010, SPW Éditions - DGARNE – DEMNA - DEE, 2010 (available for download in French, English and German)
http://etat.environnement.wallonie.be

Rapport analytique sur l'état de l'environnement wallon 2006-2007, MRW – DGRNE, Namur, 2007 (available for download in French, English and German) "La fertilité et la biodiversité dans les sols", pp. 452 ssq. – scientific report (available for download)
http://etat.environnement.wallonie.be

And also:

Service Public de Wallonie SPW – Département de la Nature et des Forêts (DNF)
www.environnement.wallonie.be/dnf/

Programme Wallon de Réduction des Pesticides (PWRP)
www.wallonie-reductionpesticides.be
www.adalia.be

Composting
http://environnement.wallonie.be

L'Environnement au jardin.
Guide de bonnes pratiques pour le respect de l'environnement dans les activités de jardinage, ZEGELS, A., SPW Éditions, les Guides de l'Éco-citoyen, 2009 (available for download)
http://environnement.wallonie.be

Comité régional PHYTO
www.crphyto.be

About risks linked to **invasive plants**
http://biodiversite.wallonie.be
("invasive" tab)

ADALIA asbl
www.adalia.be

Europe

L'usine de la vie, Pourquoi la biodiversité des sols est-elle si importante ?, European Union, 2010 (available for download)
http://bookshop.europa.eu/fr/

Soils Atlas of Europe, European Commission, Joint Research Center, 2005 (available for download)
"Decline in Biodiversity" p. 133
http://eusoils.jrc.ec.europa.eu/

European Atlas of Soil Biodiversity, Joint Research Center, European Commission, 2010 (available for download)
http://eusoils.jrc.ec.europa.eu

Teachers

- Le sol - Qu'est- ce que le sol? Comment se forme un sol? Quelles fonctions remplit le sol? Quelles sont les menaces qui pèsent sur les sols?, educational report, Prosensols, s.d. (available for download)
-Les menaces qui pèsent sur les sols, educational presentation, partenariat Prosensols, s.d. (available for download)
-Educational folder and sheets on soil (from age 12)
www.prosensols.eu

Creusons le sol, Symbioses, le magazine de l'Education relative à l'Environnement, N°98, second half of the year 2013 (available for download)
www.reseau-idee.be

Farmers

GREENOTEC asbl
www.greenotec.be

About agro-environmental measures
http://agriculture.wallonie.be
www.natagriwal.be

About the Programme Wallon de Réduction des Pesticides (PWRP - Walloon Pesticide Reduction Programme)
http://agriculture.wallonie.be

Comité régional PHYTO
www.crphyto.be

Local authorities, managers of public spaces

Comité Régional PHYTO
www.crphyto.be

Pôle de Gestion différenciée
www.gestiondifferenciee.be

Union des Villes et Communes de Wallonie
www.uvcw.be

Photography credits

p. 29 EC/JRC *European Atlas of Soil Biodiversity;* Wikipedia
p. 31 F.-X. Heynen;
SPW Jean-Louis Carpentier 4686 and 001;
Wikipedia; EC/JRC *European Atlas of Soil Biodiversity;*
p. 32 SPW Jean-Louis Carpentier 5209 and 7069 ; F.-X. Heynen;
Education-Environnement asbl A. Batteux
p. 33 Education-Environnement asbl A. Batteux; F.-X. Heynen; SPW Jean-Louis Carpentier 5150;
Education-Environnement asbl A. Batteux

Produced by: www.education-environnement.be