

Loss of organic matter

Degraded and impoverished soil



Explanation of the diagram
"The magic of soil" sheet

As well as water, air and mineral particles from weathered rocks, soil also contains **organic matter**.

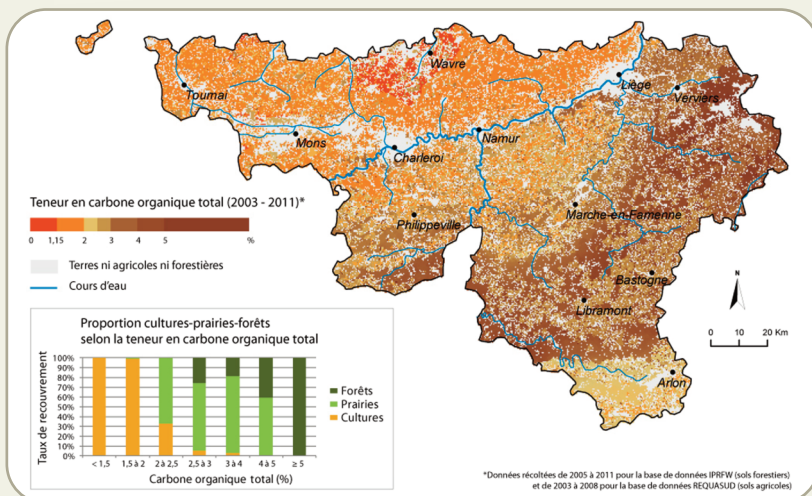
Organic matter is essential for soil's development, and for maintaining its properties and ensuring it is able to fulfil its agricultural, silvicultural (production of wood in forests) and environmental functions. If the organic matter content is too low, a soil becomes impoverished. Among other consequences, this results in a

reduction in soil's fertility and increased vulnerability to erosion.

Since the 1960s, some of Wallonia's agricultural soil has been experiencing a **concerning fall in levels of organic matter**. This deficiency can also affect gardens. However, there are ways of rectifying this problem.

In Wallonia, the soil most affected by this shortage of organic matter (containing less than 2%) is located in the main arable areas. In other words, in silty (Hesbaye), sandy-loamy (north of Hainaut) and condruzian regions. Although some stabilisation has been apparent in recent years (with the exception of silty regions), the situation is still of concern.

In Wallonia



Total organic carbon content in agricultural and forest soil (2003-2011)
Source: ICEW 2012, p. 126

What is soil organic matter?

Soil organic matter is created by

- billions of **soil organisms**, either **living** (earthworms, nematodes, insects, mites, spiders, springtails, fungi, algae, bacteria, etc.) or **dead** (plant or animal residue at varying stages of decomposition).
- humus**, a by-product of the decomposition of residue (mainly plant) by soil organisms.

Sheet number 4
"Biodiversity"



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The organic matter cycle

1 Transformation.

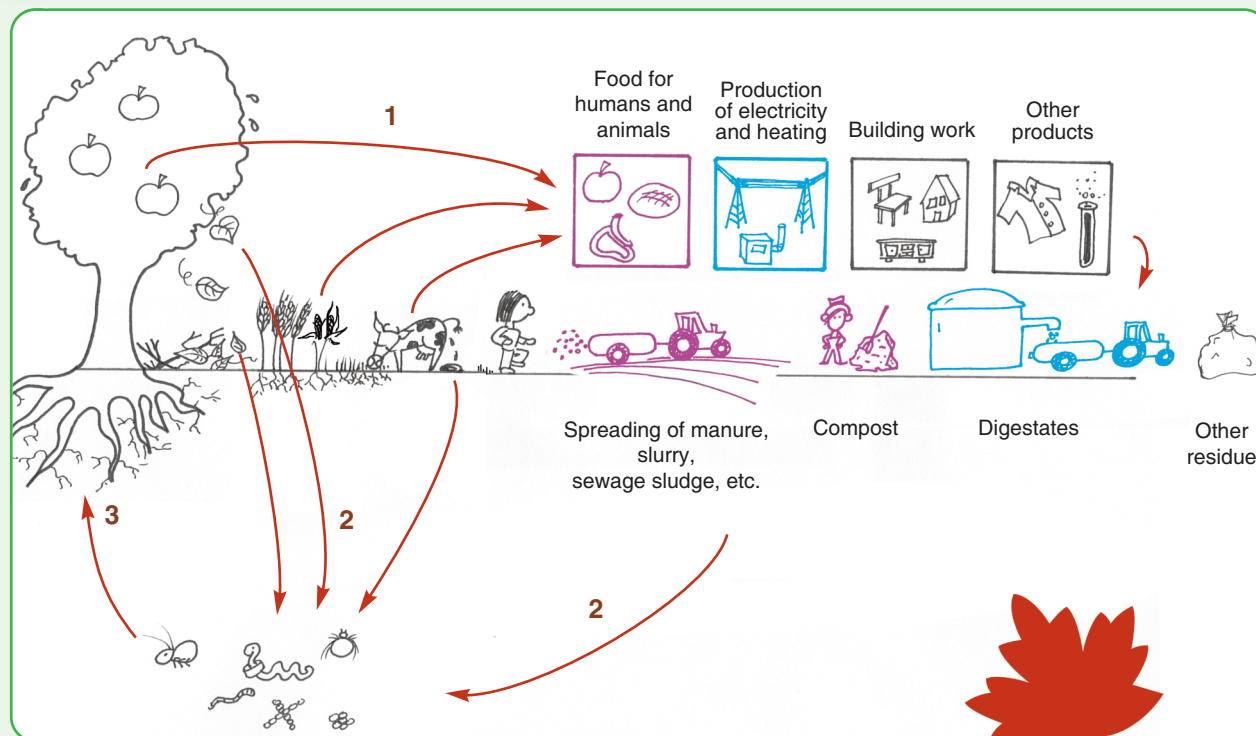
Organic matter is produced directly by plants through photosynthesis. These plants are then removed and transformed, mainly by animals and humans, for food, heating, shelter, equipment, etc.



2 Return to the soil. Organic matter returns to the soil, either directly or after transformation, in different forms (slurry, compost, digestates).

3 Decomposition and mineralisation.

Soil micro-organisms decompose, digest and transform organic matter (crop residue, dead leaves and wood, droppings, manure, compost, dead animals, etc.) into mineral elements which can be assimilated by plants. The most difficult part to digest (lignin, tannins, etc.) is transformed into *humus*, which can stay in soil for several years before it too is mineralised. Humus combines with fine particles of clay and silt, giving the soil its good cohesion.

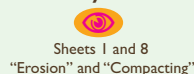


Soil rich in organic matter...

provides a wide variety of habitat and energy sources for the soil micro-organisms responsible for decomposing organic matter. It helps to maintain and increase biodiversity.



develops a more aerated and stable structure. Humus combines with fine particles of clay to form clods of soil, known as "aggregates", which increase soil's stability. Roots can penetrate more easily. Soil becomes more resistant to erosion and compacting.



is more fertile, due to the higher quantities of nutrients available for biological activity.

is capable of retaining a greater volume of rain water. This increases available supplies for plants, reduces risks of flooding and helps to refill groundwater bodies.



plays a role, through humus, in CO₂ storage and helps to combat the greenhouse effect. On its own, soil retains more carbon than the atmosphere and plants combined. Releasing all the carbon contained in soil across Wallonia would equate to an emission more than ten times the annual quantity of CO₂ generated by our consumption of fossil energies.



is more capable of retaining or degrading various pollutants, mainly through the action of certain bacteria.



Why are certain types of soil **losing** their organic matter?

Because the organic matter mineralised by micro-organisms is not being replaced!

In a natural ecosystem, lost organic matter is continuously replenished by supplies of fresh organic matter. Just think about leaves falling in forests...

On arable land, this cycle is disrupted by:

1 a lack of external addition of organic matter

When soil no longer fulfils its nutritional role as a result of a shortage of organic matter, there is often a tendency to put plants "on a drip feed" using **inorganic fertilisers**. Although these fertilisers rapidly stimulate plants' growth by providing them with certain nutrients, they do not nourish soil organisms. In some cases, they may even have a detrimental effect. For example, a nitrogen fertiliser can encourage organisms that like nitrogen and discourage the rest, resulting in an imbalance. Repeated use of these types of fertilisers to compensate for functional deficiencies in soil will eventually lead to a vicious circle. Regularly replenishing **organic matter**, in the form of soil amendments or organic fertilisers, **nourishes micro-organisms** and improves soil's properties.

 Sheet "The magic of soil"

2 uncompensated removal of organic matter

Harvesting all plant production deprives soil of the organic matter that would normally be returned under the natural cycle. Over time, this practice impoverishes soil.



3 excessive soil cultivation

-Deep *ploughing* introduces large volumes of oxygen into soil. This then increases the activity of soil organisms, causing them to consume the available organic matter at a much faster rate. Mineralisation is accelerated. If depleted organic matter is not replenished, organisms will struggle to find food and some will disappear.

-Excessive *refining of land* breaks down aggregates and makes organic matter more available to organisms. This can have the same result as deep ploughing. It also makes soil more vulnerable to erosion.

 Sheet 1 "Erosion"

4 erosion

Erosion* carries away the upper layers of soil, taking with them their rich organic matter content.

*erosion: detaching of particles of soil by wind or rain



Maintaining and increasing organic matter **content** in soil



Soil is a complex medium and its characteristics and “performance” vary depending on its structure, texture, acidity (pH), climatic factors and organic matter content. **Analysing your soil** provides you with a precise picture of the nutrients it contains or lacks and allows you to take the appropriate remedial action.



Organic matter can be replenished

with compost, peat, mulch, manure, green manure (phacelia, mustard), etc.



Gardeners may **bury organic matter** partially and slightly in soil. Avoid working soil too deeply (to avoid accelerating mineralisation) or refining it too much (risk of breaking down aggregates).



Growing plants in your garden offers several benefits. The roots make a significant contribution to the production of organic matter. Plant debris is used to create humus.



If you produce your own “home-made” compost, it is important to ensure balanced proportions of carbon matter (shredded branches, dead leaves, straw) and nitrogen matter (fruit, vegetable peelings, grass cuttings, manure, etc.). Monitor hygiene conditions and avoid causing any kind of nuisance.



Mustard



Phacelia

Fertilisers and company...

-Fertilisers: natural, agricultural or industrial products which improve soil's fertility.

Fertilisers include:

Inorganic or organic **fertilisers** which provide plants with nutrients to encourage their growth;
Inorganic or organic soil amendments (such as compost, manure, lime, etc.) which aim to improve soil's physical, chemical or biological properties.

-Peat: earth extracted from the layers of soil with the richest organic matter content and supplemented with plant organic matter, mineral matter (e.g. lime), etc.
Some plants can be grown directly in this peat.



Sheet "The magic of soil"

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:

Composting
<http://environnement.wallonie.be>

Composter les déchets organiques. Guide des bonnes pratiques pour la transformation des déchets de cuisine et de jardin, ZEGELS, A., SPW Éditions, Les Guides de l'Éco-citoyen, 2012 (available for download)
<http://environnement.wallonie.be>

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)
-La matière organique, educational report, partenariat Prosensols, 2010 (from age 15-16)
-Les menaces qui pèsent sur les sols, educational presentation, partenariat Prosensols, s.d.
-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
www.reseau-idee.be (available for download)

Europe

European Commission, *Soils Atlas of Europe*, Joint Research Center, 2005

“Loss of organic matter” p. 112
<http://eusols.jrc.ec.europa.eu/>
 (available for download)

Soil analyses

Province of Liège

Station Provinciale d'Analyses Agricoles
 Rue de Dinant, 110 (Quatre-Bras), 4557 Tinlot (Scry)

Tel. : 085 243 800 | Fax : 085 243 801
 Email: spaa@provincedeliege.be
www.provincedeliege.be/agriculture/node/204

Province of Hainaut

CARAH asbl
 Rue P. Pasteur, n° 11 - 7800 Ath
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www.carah.be

Province of Walloon Brabant

Centre Provincial de l'Agriculture et de la Ruralité
 Rue Saint - Nicolas, n° 17 - 1310 La Hulpe
 Tel.: 02 656 09 70 | Fax: 02 652 03 06
 Email: agriculture.brabantwallon@skynet.be
www.brabantwallon.be

Province of Luxembourg

Le Centre de Michamps
 Horritine 1 — 6600 Bastogne
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 Email: centredemichamps@uclouvain.be
www.uclouvain.be/80364.html

Province of Namur

Office Provincial Agricole
 Domaine de Saint-Quentin - 5590 Ciney
 Tel.: 081 77 68 16 | Fax: 083 21 76 03
 Email: office.agricole@province.namur.be
www.opaciney.be

Farmers

NITRAWAL
www.nitrawal.be

GREENOTEC asbl
www.greenotec.be

Filières de valorisation agricole des matières organiques, CULOT, M., FUSAGx – LEMEE, 2005 (available for download)
<http://environnement.wallonie.be>

Le compostage des fumiers, une technique de valorisation des matières organiques en agriculture, LUXEN P. et al, Les Livrets de l'Agriculture, n°3, Walloon Regional Ministry, Agriculture General Directorate, 2006 (available for download)
<http://agriculture.wallonie.be>

Physio-chemical soil analysis laboratories

REQUASUD asbl laboratory network (REseau-QUALité-SUD)
www.requasud.be

Photography credits

p. 23 SPW Jean-Louis Carpentier 7205; Education-Environnement asbl; European Atlas of Soil Biodiversity EC/JRC; Education-Environnement asbl;
p. 25 SPW Jean-Louis Carpentier 5287; F.- X. Heynen; SPW Jean-Louis Carpentier 8093
p. 26 SPW Jean-Louis Carpentier 0045, 6819 and 328

