



Explanation of the diagram
"The magic of soil" sheet

Particles affected by erosion are detached by rain, swept down slopes and deposited in a new location. Although erosion is a natural phenomenon, it can be aggravated by human activities (buildings, farming, etc.) and methods used to develop land or areas around houses.

In Wallonia, agricultural land is most affected by erosion. Ensuring the preservation of this

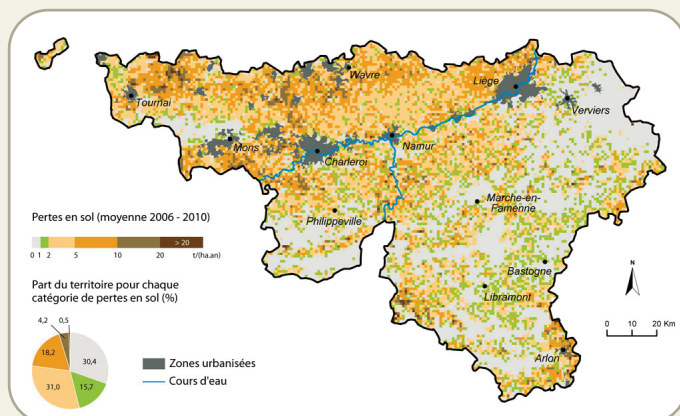
arable land is a key issue for our future. There is also the high cost of repairing erosion-related damage to housing and public infrastructures, in particular as a result of mudslides.

This explains why combatting erosion is now a **priority**.



Agricultural soil most affected

Every year, water erosion is responsible for an average loss of around three tonnes of soil per hectare throughout Wallonia, across all types of soil. However, agricultural land is hardest hit, with around 40% of the total agricultural surface area experiencing annual losses in excess of 5 tonnes per hectare. Regions with silty and sandy-loamy soil are most at risk, due to these soil types' vulnerability to erosion and the predominance of low-cover crops in spring, the season that tends to have the most erosive rainfalls.

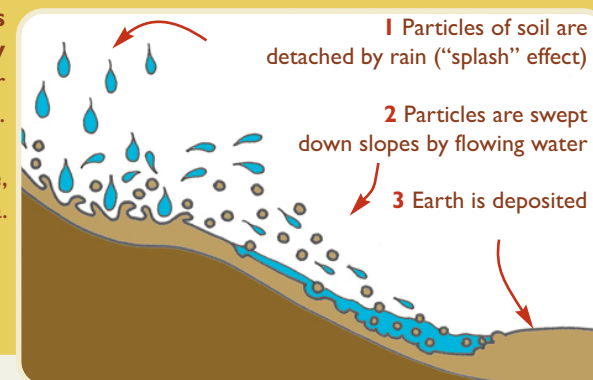


Soil loss due to water erosion
Source: ICEW 2012, p. 125

WHAT IS erosion?

Erosion occurs when **particles of soil are detached and carried away by rain** (water erosion), **wind** (wind erosion) or **agricultural activities** (tillage erosion).

We will not look at wind erosion here, as this is a rare phenomenon in Wallonia.



What causes erosion? > Page 12
Why is erosion a problem? > Page 14
What can we do to reduce soil erosion? > Page 15

What causes erosion?

Erosion is a complex phenomenon. **It is caused by different factors, often acting in combination.** These factors can be natural (structure, climate, etc.) or human (vegetation cover, soil cultivation methods, etc.).

What determines soil's **vulnerability** to erosion ?

1 Its structure

Soil's structure is the way its components are combined to form (or not) small clumps called "aggregates". Soil's structure depends on **two factors**:

•The texture of the soil

Soil's "texture" is determined by the proportion of sand, clay and silt that it contains.



Sandy soil (higher proportion of sand) is not vulnerable to erosion. Although the grains of sand do not bind together (low cohesion, sand runs through your fingers), they are relatively heavy and less likely to be swept away by rain. This type of soil is very permeable: water is rapidly absorbed rather than flowing over its surface.

Silty or sandy-loamy soil is most vulnerable to erosion. These soil types have average permeability and low cohesion: the particles are therefore at greater risk of being detached and swept away by water. These are the predominant soil textures found in our main arable regions of Hesbaye, Walloon Brabant and Hainaut.

Clay soil is one of the types least vulnerable to erosion. Its permeability is low, but its cohesion is high ("sticky"). However, as water runs over the surface of this type of soil rather than being absorbed, this increases the likelihood of the formation of gullies* in fields.

* gullies : relatively deep furrows carved out by rain.

•Soil's humus content

Humus is formed by the decomposition of organic matter (plant residues, manure, etc.) by fungi and soil organisms. Humus increases cohesion between particles: it combines with mineral soil particles (clay and silt) to form aggregates. The resulting soil **structure** is less vulnerable to erosion.



Sheets numbers 3 and 4
"Organic matter" and "Biodiversity"

2 The climate and rainfall intensity

Rainstorms can be violent and intense: high volumes of water fall within short periods of time. The soil is unable to absorb all this water. Water then flows over the surface, carrying with it particles of soil. The large raindrops that fall during storms also detach more earth. This explains why the worst mudslides tend to occur in the wake of storms. Wallonia experienced particularly "erosive" rainfall in 2002 and 2011. Unfortunately, this type of rainfall appears to have become more frequent since the 1970s.



3 The relief: gradient and length of slopes

Erosion can be aggravated by long slopes with steep gradients, due to the faster flows of water and higher volumes. In the 1970s, the merging of agricultural parcels in some cases resulted in very long slopes with no vegetation to slow down flows of water (hedges were removed). Erosion issues are now being considered in land consolidation and vegetation is being replanted to slow down or prevent erosion.



4 The addition of organic matter

Organic matter* enriches soil with nutrients and improves its structure, an essential factor in its fertility and protection from erosion.

In Wallonia, our main arable regions have been suffering from a shortage of organic matter (and therefore humus) for several years: systematically removing crop residues prevents organic matter from returning to the soil. This situation partly explains cultivated soil's vulnerability to erosion.



Sheet number 3 "Organic matter"

*not to be confused with the addition of fertilisers, such as inorganic fertilisers (nitrogen, phosphorus, etc.) which provide plants with direct nourishment but have no other beneficial effect.

5 The mechanical cultivation of the soil and machinery used

Soil's structure is influenced by the methods and machinery used to cultivate the land. For example, cultivating the earth too finely reduces soil cohesion by breaking up aggregates. Water can form very deep furrows (channels or gullies) in destructured soil. Extensive work is then required to restore the condition of the land. The weight and repeated movements of agricultural machinery compress soil, eventually making it impermeable: rather than seeping into the earth, water runs over its surface, taking with it particles of soil. The movements of agricultural machinery also result in the formation of ruts. Water flows along these ruts, picking up speed and detaching far higher quantities of earth. This aggravates the phenomenon of erosion. Finally, techniques used to dig out tuber crops (potatoes, beetroot, etc.) can also remove large quantities of earth.



Sheet number 8 "Compacting"

6 The vegetation cover

Vegetation (trees and shrubs, grass, hedges, copses, cover crops, etc.) slows down water runoff, absorbs water and alleviates the impact of raindrops on the soil. Vegetation's roots and rootlets also help to hold soil in place: "bare" soil is therefore much more vulnerable to erosion.

Some crops, known as "row" crops (corn, beetroot, potatoes, etc.), are planted in rows or mounds, leaving bare strips of earth. These crops, which are particularly predominant in the area north of the Sambre and Meuse rivers, are often responsible for mudslides.



Why is erosion a **problem**?

Soil affected by erosion...



loses its agricultural potential.

A vital farming resource disappears! Earth particles are detached and carried away, taking with them nutrients (fertilisers, organic matter, etc.) and soil fauna. This results in impoverishment of the soil and a reduction in the thickness of the top soil. Seedlings are uprooted or drowned.



Sheet 4 "Biodiversity"



causes mudslides.

Damage to infrastructures, highways and housing is often extensive and costly.



disrupts aquatic environments and degrades the quality of surface water.

Detached earth particles slide down slopes until they reach a watercourse. This has a detrimental effect on the natural habitat of fauna and flora (for example: the mud can cover the gravel in which trout lay their eggs). Any fertiliser or pesticides in the earth also represent a potential source of pollution.



Sheet 6
"Diffuse pollution"



increases the risk of rivers bursting their banks.

An influx of earth can cause siltation of a watercourse, a change in its path or even bursting of its banks.



impedes river traffic.

Silting of navigable waterways requires very costly cleaning or dredging operations.



What can we do to **reduce** soil erosion?



Although individuals can contribute to alleviating erosion, this often requires an overview from the perspective of the municipality or even drainage basin*.

* drainage basin: area of land within which watercourses all flow to the same place (river, lake, sea).

Specialists supporting municipalities

GISER unit The Direction du Développement Rural du SPW (DGO3) (Walloon Region Rural Development Directorate) has set up an advisory and research unit called GISER: Gestion Intégrée Sol Erosion Ruissellement (Integrated Management of Soil Erosion and Runoff). Its mission is to analyse erosion mechanisms and suggest effective countermeasures. The GISER unit supports all Walloon municipalities affected by flooding problems caused by water runoff and mudslides from agricultural areas. The team visits the affected area, performs a detailed diagnosis and supports the implementation of concerted solutions.

DAFOR Direction de l'Aménagement Foncier Rural du SPW (DGO3) (Wallonia Rural Land Development Directorate) provides technical advice and funding to municipalities for the performance of work or developments aimed at containing earth and slowing down flows of water (hedges, embankments, dykes, storm water basins, temporary discharge areas, etc.).



Concerted efforts

Long-term solutions will require concerted efforts by local councillors, managers of watercourses, farmers and citizens. Attending any discussions or round tables organised in your local area can be a useful way of finding out more about these issues.



Beside water

Do not obstruct areas close to a water course: respect rights of way and allow access for maintenance equipment. Maintain trees by cutting them back every 5 to 8 years, and mow or cut low-growing vegetation each year.

Farmers

Alternating ploughing directions, simplified or non-ploughing soil cultivation techniques, mulching, grass areas, anti-erosion strips, reduction in parcel size, maintenance of hedges, and more. A variety of techniques can be used to protect soil and alleviate erosion.

Wallonia supports various advisory services created to assist farmers: Greenotec (simplified cultivation techniques), Natagriwal (agro-environmental advisors).

Grants are available to support *environmentally friendly* agricultural investments (ISA (agricultural investment support)) and erosion-control measures (agro-environmental assistance).



Around the house

Opt for permeable or semi-permeable surfaces which allow water to seep through.

Use or adapt natural features to slow down flows of water in your garden, for example, strips of grass.

Shrubs and bushes with dense roots are natural allies in the battle against erosion. To promote biodiversity, choose indigenous varieties where possible.

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)
www.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)
www.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) – dossier scientifique (available for download in French, English and German)
www.etat.environnement.wallonie.be

GEOPORTAIL DE LA WALLONIE (WALLOON REGION GEOPORTAL) (mapping and online database)
www.geoportail.wallonie.be
éRosis-RUISselement-SOL (ERRUISSOL) database (soil, erosion and runoff database)
Areas at risk of erosion problems, sheet flows and/or concentrated flows.

And also...

Réseau Wallon de Développement rural (PWDR) (Walloon Network for Rural Development)
www.reseau-pwdr.be

Gestion intégrée “sol – érosion – ruissellement”: les communes impliquées, dans Mouvement communal, n° 873, December 2012, pp. 49-50
www.uvcw.be

Belgique et Europe

Erosion des sols en Belgique, état de la question, Katleen GILLIJNS et al., KINT-IRGT, Brussels, 2005
www.giser.be

Soil Atlas of Europe, European Soil Bureau Network, European Commission, 2005 – “Erosion” pp.111 ssq.
www.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)

- *L'érosion du sol*, 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)

Farmers

Réseau wallon de Développement rural, *Erosion, coulées boueuses et inondations*, Carnet du Réseau n°1, December 2011
www.reseau-pwdr.be

Lutter contre l'érosion des sols, Sylvia DAUTREBANDE, Hélène CORDONNIER, Marc THIRION, Charles BIELDERS, Les Livrets de l'Agriculture, N°12, Walloon Regional Ministry, Agriculture General Directorate, 2006
www.giser.be

GISER unit – SPW – DGO3
www.giser.be

GREENOTEC asbl
www.greenotec.be

NATAGRIWAL asbl
www.natagriwal.be

DAFOR - SPW - DGO3
www.agriculture.wallonie.be
Home>Documentation>Reports>Erosion and risks of water runoff:

Mapping of areas at risk of water runoff and erosion in the Walloon region:
Methodology and pilot cases

Methodological guide for choices of appropriate measures to preserve soil and water

Photography credits

p. 11 GISER;

p. 12 SPW Jean-Louis Carpentier 3600;

p. 13 F. X. Heynen;

SPW Jean-Louis Carpentier 8093;

SPW Jean-Louis Carpentier 8356;

SPW Jean-Louis Carpentier 0331;

p. 14 UCL Ch.Bielders;

p. 15 GISER