LOSS OF ORGANIC MATTER. An imbalance between the build-up of soil organic matter and rates of decomposition is leading to a decline in soil organic matter contents in many parts of Europe.

A Histosol, a soil rich in organic matter. Most mineral soil contains less than 10% organic matter (6% organic carbon) in the topsoil (EM).

The presence of organic matter is extremely important in all soil processes, acting as a storehouse for nutrients and a source of soil fertility, contributing to soil aeration, thereby reducing soil compaction, and ensuring good structure. Other benefits are related to the improvement of infiltration rates and the increase in storage capacity for water. Furthermore, organic matter serves as a buffer against rapid changes in soil pH and it acts as an energy source for soil micro-organisms.

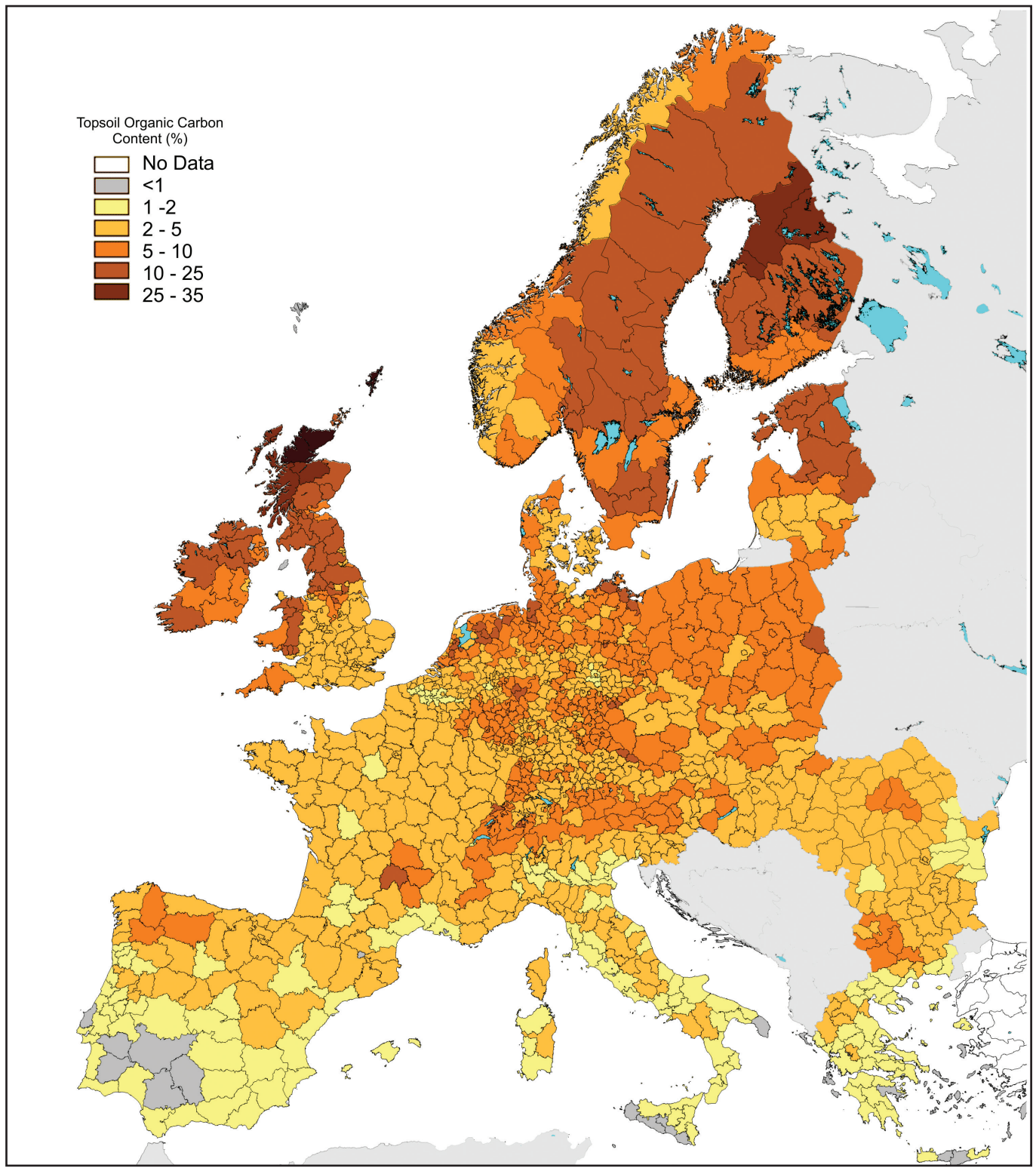
The amount of organic matter stored in soil is thus of great importance and, in the past few years, there has been increasing concern about declining levels leading to increased soil degradation (loss of structure and fertility), erosion and desertification. There are two groups of factors that influence the inherent levels of soil organic matter content: natural factors (climate, soil parent material, land cover and/or vegetation and topography) and anthropogenic or human-induced factors (land use, management and degradation).

Concerning climate, within belts of uniform moisture conditions and comparable vegetation, the average amount of organic matter increases by two to three times for each 10 deg C decrease in temperature, because decomposition rates reduce as temperatures decline. In general, organic matter increases as the effective soil moisture becomes greater, poorly drained soils generally having much higher organic matter contents than their better-drained equivalents. This is because decomposition of organic matter requires oxygen and this is in short supply in waterlogged soils.

A sandy soil usually contains less organic matter than a soil of finer texture, e.g. heavy loam or clay. This is because oxygen is required for decomposition of organic matter and poorly drained soils have low oxygen contents and fine textured soils are generally poorly aerated.

There are several factors responsible for the decline in soil organic matter and many of them stem from human activity:

- Conversion of grassland, forests and natural vegetation to arable land;
- Deep ploughing of arable soils causing rapid mineralisation of organic matter:



The map above shows the distribution of soil organic carbon, a major component of organic matter, according to administrative units; it emphasises the generally low levels in southern Europe compared to the north (RH).

- Overgrazing;
- Soil erosion;
- Forest fires.

In essentially warm and dry areas like Southern Europe, depletion of organic matter can be rapid because the processes of decomposition are accelerated by high temperatures. Some areas in southern Spain for example have experienced serious depletion of organic matter through changing land use and recently adopted management practices. It is clear that human occupation over the past 5000 years in this part of Europe gives us an idea of how other parts of the continent could be affected in the future.

This is an area east of Sevilla where olive cultivation has become almost a monoculture. The removal of soil and hence organic matter from the soil upslope is clearly visible (white area), the topsoil becoming browner lower down (RJ).

Degradation of peat soil in the Netherlands

There is evidence to suggest that the organic matter content of soils in Europe is decreasing, in some cases at an alarming rate.

- In Roman times, 45% of the Netherlands was covered by peat. Today, the figure is around 8%, most of which is used as pasture.
- In the 1970's the area of peat was about 290,000 ha. In recent years, water levels in ditches in the peat areas has been lowered to 60 cm – 120 cm below the surface (compared to originally 20-30 cm), which resulted in an increased oxidation of the peat and an average subsidence of the soil of 1 cm per year.
- Nowadays, the area of peat soil is about 220,000 ha. Thus, over the last thirty-five years, 70,000 ha of peat soil has degraded to an other soil type.
- A subsidence of 1 – 2 cm per year equals to 14 tons of peat per hectare (ha) per year. The oxidation of 1 cm per year results in a production of 22.6 tons/ha/year of CO_2.
- In the Netherlands the CO_2 emission of peat soil is about 3% of the national CO_2 production (in 1990). In a country like Norway the production of CO_2 from peat in agricultural use is higher than the production of CO_2 by the traffic.

Organic or mineral?

Soil scientists often use the term "*mineral soils*" to describe soils composed predominantly of mineral material which are low in organic matter or humus content. The soil profile below the A horizon is normally all mineral soil. A mineral is a natural crystalline inorganic substance. Silica is a mineral but coal is not because it is derived from organic material (i.e. plants).