Soil and climate change

European Environment Agency

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Human and ecological systems rely on soil for the provision of water and nutrients for plant growth, the regulation of the water cycle and the storage of carbon. Climate change and its impacts — increases in temperature, changing precipitation patterns, floods, droughts — will not only affect us but may also affect how soil provides these services. Importantly soil is a major factor in our response to tackling climate change as it is the second largest carbon pool after the oceans.

It is estimated that in the EU around 75 billion tonnes of carbon is stored in soil (EC, 2009) [1]. To illustrate its importance in 2006 the total carbon emission in the EU amounted to approximately 1.5 billion tonnes (EEA, 2008).

EU soils may act as a modest sink for carbon. However, current estimates of changes in soil carbon stocks have high uncertainties. A recent study, based on the extrapolation of the results of studies on the changes occurring in three land uses (grassland, cropland and forest soils), estimates a net yearly accumulation of carbon in the EU soils in the range of 1 to 100 million tonnes [2] (EC, 2009). Larger accumulation would be possible with proper management.

Soil carbon sequestration cannot be alone the solution due to the limited magnitude of its effects and its potential reversibility. Nevertheless, it could play an important role in climate mitigation in the short term together with other measures, especially because of its immediate availability and the relatively low cost.

These figures illustrate that soil is essential in the debate on how we tackle climate change, as the release of just a small fraction of the soil carbon stock could offset the savings achieved elsewhere.

Soil carbon losses are driven by changes in land use — especially drainage of peatlands —, land management and climate, which may lead to soil degradation and the loss of soil organic matter. In the northernmost parts of the continent, the melting of permafrost, with the consequent release of methane and CO_2, is also contributing to the atmospheric carbon pool.

For example, in the United Kingdom, losses may amount to more than 13 million tonnes since 1990 (Bellamy, 2008). This estimated loss corresponds to about 10 % of the annual UK industrial carbon emissions (2006), which is approximately the same as the reduction of industrial CO_2 emissions in the period 1990-2006.

Climate change is expected to have an impact on soil (EEA, 2009a; EEA, 2009b; EEA-JRC-WHO, 2008). However, the interrelations between climate change and changes in soil quality are complex and still under study. As a consequence predictions, which are based on hypothetical scenarios and data obtained under controlled conditions, are still more qualitative than quantitative. But, it is clear that tackling climate change cannot be done without a better understanding and management of our soils.

Footnotes:

[1] According to these estimates, the soil carbon content in the EU27 may range between 73 and 79 billion tonnes (EC, 2009). In the European Union, approximately half of the carbon stock in soils is located in Sweden, Finland and the UK. A large part of the stock, about 20%, is stored in organic soils, mainly in the northern regions.

[2] In general, forest and grassland soils adsorb carbon while cropland is a carbon source.

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