

UK citizens may have to adjust to warmer, drier, summers and wetter winters as the climate changes. **Andrew Tye** describes how our soils will be affected and explains that farmers and gardeners are not the only ones who will suffer from the consequences.

Soil stability

Scenarios published by the UK Climate Impacts Programme suggest that greenhouse gas emissions will lead to significant changes in our climate: the UK will become warmer, winters wetter and summers may become drier. Heavy winter rainfall may also become more frequent. We can expect a wide range of effects on the functions of the soil and its parent material. These may include impacts on biogeochemical cycles, plant and soil interactions, aquifer replenishment and river flow, soil erosion, soil biology and building foundations. There could be a major effect on the UK economy. The BGS has initiated various projects that will help us understand the potential effects of climate change on soil and the soil parent material. This work is largely being carried out within our Sustainable Soils and Physical Hazards programmes.

from UK soils. The greatest losses were from those soils with the highest organic carbon concentrations, such as peats.

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The role of soil carbon is pivotal in both the global carbon cycle and in the functions of the soil and soil parent material. Soils act as major terrestrial carbon sinks and the carbon stored in them helps to maintain soil fertility and structure. It is a component of the filter function performed by the soil, helps to

store water and prevents wind and water erosion. It has been estimated that over 2500 million tonnes of carbon is held in UK topsoils within 30 centimetres of the surface. However, a recent resampling survey by the National Soils Resource Institute estimated that, in the last decade, 10% of topsoil carbon was lost

Our work will help us to understand whether climate change is reinforced by increasing carbon dioxide emissions from soils. One suggestion is that the increasingly warm and dry weather experienced in the UK, along with



Severe heave, in Fuller's Earth (montmorillonite) under a squash court at Monkton Combe, Bath. The heave is caused by the expansion of the clay minerals as they absorb water.



'Centre Lift' caused by shrinkage of London Clay (Peter Kelsey & Partners).

changes in land use, is responsible for increasing the microbial degradation and oxidation of organic carbon. Some of this oxidised carbon will be released to the atmosphere as carbon dioxide, while some will be lost to deeper soil layers and watercourses as dissolved organic carbon.

One of the major problems that we are hoping to address, is that the size of the UK's organic deposits is not systematically documented. These deposits include not only the upland peat soils but also organic deposits found on the alluvial plains of rivers, clays with high organic contents (such the Kimmeridge Clay) and estuarine sediments. We need improved estimates of the carbon stocks in UK soils to improve the accuracy of organic carbon audits in the UK soils and sediments.

“ impacts on biogeochemical cycles, plant and soil interactions, aquifer replenishment and river flow, soil erosion, soil biology and building foundations could have a major effect on the UK economy”

We are assessing a rapid measurement method for organic carbon in soils using infrared spectrometry. This work involves examining the carbon stocks above the Sherwood Sandstone outcrop in Nottinghamshire as part of a project that is investigating variations in the cation-exchange capacity above this important aquifer. This project draws on the sample archive obtained from the Geochemical Baseline Survey of the Environment (G-BASE). Developed land accounts for 8% of the UK and little information currently exists regarding carbon stocks. We can use the Geochemical Survey of the Urban Environment (G-SUE) archive to assess carbon in urban soils.

We are reviewing the effects that predicted climate change could have on geohazards across Britain, including shrink–swell, landslides and dissolution of soluble rocks, using the extensive information we hold in the National Geotechnical Database and National



The A85 Lochearnhead landslide occurred in August 2004 after very heavy rain. It started off as a small landslide and became a debris flow trapping 57 people.

Landslide Database. The annual cost of subsidence caused, in part, by shrink–swell is currently estimated to total about £500 million and illustrates the economic importance of this work. Clay soils susceptible to shrink–swell include those formed by the Gault Clay, Mercia Mudstone Group, Lambeth Group, Lias Group clays and London Clay. These underlie extensive areas of south-east England, where drier summers and wetter winters may exacerbate problems for householders.

The effects of subsidence may also be related to changes in the height of the water table. For example, a lowering of the water table may lead to oxidation of organic matter in floodplain soils resulting in subsidence, a process that may affect the Thames Gateway area.

One of our further aims is to create a Parent Material Erodibility map based on slope, position within the landscape, soil texture, and permeability so that the potential risk from river and wind erosion can be assessed.

We hope that our programme will help us to devise strategies to overcome the problems caused by climate change in the soil.

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For information on the UK Climate Impacts Programme, visit:
www.ukcip.org.uk