One of the hidden impacts of global warming could be the cost to homeowners and their insurers. **Matt Harrison** describes new products to help identify the properties most at risk.

# Geohazard information

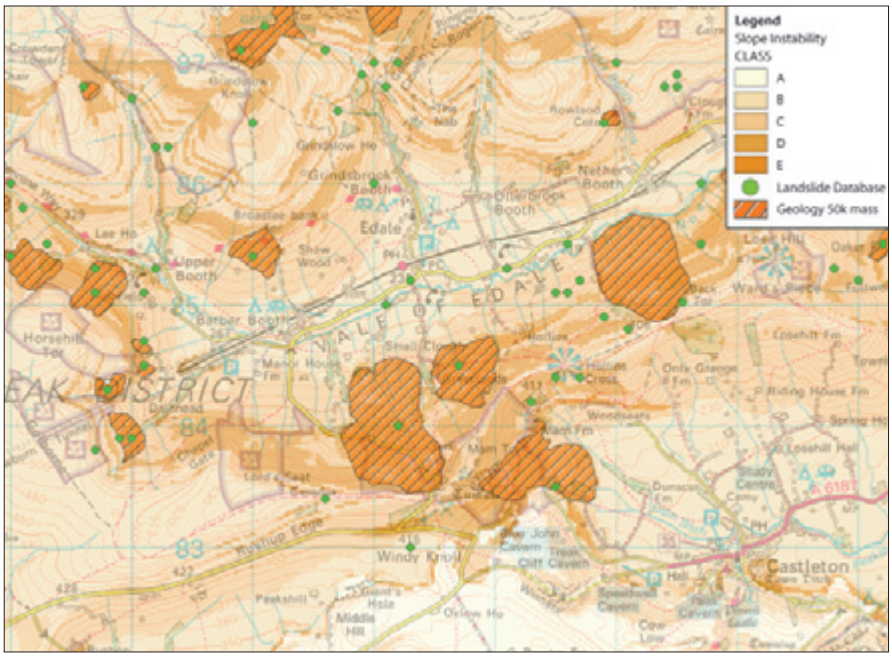
Geological hazards, or geohazards, represent a significant, but often unrecognised, threat to people and their homes in the UK. This is demonstrated by the additional costs incurred by the civil engineering industry due to unforeseen ground conditions and by post-construction losses sustained by the insurance industry due to building damage (in excess of £300 million per annum). Homeowners are also becoming aware of the dangers and an assessment of geohazards is often carried out during the house-buying process. These geological hazards also form part of the larger earth–climate system and some are directly affected by climate change.

Where a geohazard is likely to be present, the use of the land can be modified to ensure that the hazard is not triggered, or that its effects are mitigated. To enable us to recognise and manage the risks associated with geohazards, a team at BGS have created GeoSure — six digital datasets explaining the distribution of each of the significant geohazards in Great Britain. These hazards are:

- *shrink–swell clays*, where the clays can dry out and shrink, or absorb a lot of moisture and swell, leading to cracks opening in house walls
- *landslides*, where the rocks can slide downhill under certain conditions
- *compressible deposits*, where deposits like peat can be squashed over time under the load of buildings
- *soluble rocks*, where limestone and salt rocks can dissolve, leaving underground cavities that can collapse
- *running sand*, where sand can flow to fill an excavation
- *collapsible deposits*, where certain fine-grained rocks can collapse when loaded for the first time.

Of these geohazards, the first three are especially likely to be affected by future climate change, as each of these is partly controlled by moisture and changes in the water table. The UK Climate Impacts Programme (UKCIP) suggests long-term changes in both of these factors. For example, the drier summers and wetter winters that are predicted may increase the risk of a hazard occurring so we need to understand where the areas of high potential hazard are.

*Slope instability* hazards are associated with areas that have a particular combination of geology, steepness of slope and raised water table. With accurate data we can calculate the potential for landslide using a range of models. To be able to do this regionally






*Map showing the distribution of landslide hazard potential.*

we draw on our good understanding of the behaviour of rock and soil formations as well as their water saturation. Increased rainfall could lead to elevated water saturation levels therefore increasing the hazard.

*Shrink-swell* hazards are caused by clay-rich deposits that can absorb and lose water with seasonal or longer-term changes in moisture. Local factors, such as tree roots or leaking pipes can also be significant where the shrink–swell potential is high. Deposits such as the London Clay, that have a high shrink-swell potential, cause major problems for engineers and the insurance industry. Shrink–swell clays are one of the largest causes of domestic UK insurance loss annually.

*Compressible deposits* are those that may compress or settle differentially. They are common in lowland settings, such as former river deposits and estuaries, as well as upland settings, where the peat content of the material is high. They are particularly vulnerable to change and under different climatic conditions may alter their behaviour.

The BGS has a long history of geohazard work at a site-specific scale. We have done a lot of research on ground stability, geomorphology and erosion, and developed several tools that predict change. However, this work is localised and planners, insurers and policy-makers need to predict how changes will occur at a regional, national or strategic scale.

The main interests of land-use planners in climate change lie in avoiding the major negative impact. They require appropriate information about the distribution of geological hazards, and how these will respond in relation to climate change, so that they can make sound decisions. Thus the land can be brought into its optimum use and the threat to life and property is minimised.

Our GeoSure data has been developed using geographical information systems (GIS). These handle spatial data such as digital geological map data, and can integrate information about the factors that identify each hazard, through the inclusion of expert local knowledge. This system leaves a fully auditable trail leading to the final classification of the ground and allows the assessment to be validated and updated automatically with new data or changes in climatic or management scenarios.


*Map showing the distribution of swelling and shrinking clays in Great Britain.*

The creation of a geohazard-potential GIS layer or map is only part of the process of communicating geohazard information. The other part is the descriptive key that explains how the assessment was made and its implications for the user. Explanatory keys use ratings defined by the assessment criteria and with additional text in each category that gives the implications for a particular user group. For example, where there is a high potential for shrink–swell hazard a homeowner is advised not to plant or remove trees without expert advice.

The factors causing hazards are well understood and the distribution of affected rocks is increasingly identified using products like GeoSure. This allows alternative climate change scenarios and management strategies to be explored, minimising the negative impacts. In the future we hope to incorporate additional weather and climate information to further enhance our understanding of changing geohazard distribution.

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