



**British
Geological Survey**
NATURAL ENVIRONMENT RESEARCH COUNCIL

UK Skills Scoping Report for Science and Environmental Issues Challenges

Physical Hazards Programme

Commercial Report CR/07/059N



BRITISH GEOLOGICAL SURVEY

PHYSICAL HAZARDS PROGRAMME

COMMERCIAL REPORT CR/07/059N

UK Skills Scoping Report for Science and Environmental Issues Challenges

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Coombe Farm Landslide
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Foreword

This report is the published product of a scoping study by the British Geological Survey (BGS), funded by UK Skills, to design challenges to enable competitors to gain skills relevant in the fields of Science and Environmental research.

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Summary

This report describes proposals for 5 challenges designed to enable competitors to gain skills relevant in the fields of Science and Environmental Issues research. The areas covered by the proposed challenge are Geology and Climate Change, Carbon Footprint, Energy – Resources and security of supply, Biodiversity & Geology and Land Use Conflict and Natural Resources.

1 Introduction

This report describes the results of a scoping study for science and environmental issues competitions, carried out by the British Geological Survey, funded by UK Skills, to identify potential areas of research for investigation as part of a UK Skills challenge. Five competitions are proposed based on the following broad themes;

1. Geology & Climate Change
2. Carbon Footprint
3. Energy - resources and security of supply
4. Biodiversity & Geology
5. Land Use Conflict and Natural Resources

The proposals are aimed at young people from 14 to 16 years of age who have an interest in geology, energy, environment and climate change, and want to gain skills and experience to progress in these areas of scientific and environmental research. They are aimed at **foundation** (pre-employment) level of knowledge. They are designed as **passive** competitions, to be completed remotely and submitted by email or post for judging.

All proposals cover the fundamental skills required for many job roles within the science sector. These include;

1. Analysis and interpretation of data
2. Reading and interpretation of maps and data
3. Report writing

Further skills are individual to each proposal and are outlined within each section.

2 Proposal 1: Geology & Climate Change

2.1 BACKGROUND

The Issue: Based on predicted levels of climate change, experts are predicting dramatic impacts to the UK. However, the consequences of these changes are not yet fully understood.

The UK should expect a 4°C rise in temperature by 2080 (BBC climate change experiment, 2006). Heatwaves are on the rise and, by 2080, it is predicted that summer temperatures of 40°C will be common. Winters will also be warmer. Summer rainfall is set to decrease and the UK can expect more frequent droughts. Winters will bring less snow and more rain, especially in the north and west of the country. Storms may be more frequent and more severe.

Communities built on floodplains may experience more flooding and cliffed coastlines may experience increased erosion. In cities, sewers may not be able to cope with the increased amount of rainfall. The geology beneath built up areas may shrink and swell, reacting to changes in water regimes, causing instability in our homes. Rising sea levels and more storms may lead to an increase in storm surges. If our Thames defences are overtopped, central London could be flooded. Other smaller communities may be considered not worth protecting from rising sea levels, and will have to be abandoned. The full consequences of these changes in climate are not yet understood and further research is required to gain an increased understanding of the effects in different regions of the country.

2.2 AIMS AND OBJECTIVES

The aim of this task is to get the competitors to assess the information provided on UK climate change, and apply it to a study area and assess the potential geohazards in each of the catchments within it. The study area will contain many different terrains each with associated potential geohazards. For example:

- Landslides associated with highland terrain
- Flooding of coastal regions
- Erosion of cliffed coastlines
- Flooding of rivers valleys and floodplains
- Shrink swell issues in areas of clay rich geology

Using the information provided, competitors should produce a report outlining how the main geohazards will present a risk to the area under various climate change scenarios, including:

- Increased rainfall
- Rising temperatures
- Rising sea levels
- Increased storminess
- Increased seasonality

The competitors are expected to produce a detailed report of their conclusions.

2.3 TIMING

It is suggested that the competitors are given 1 day to complete this challenge.

2.4 DATA AND TOOLS PROVIDED

A GIS (Geographical Information System) of the study area will be provided, containing geological and topographical information layers. The GIS will be made available in ArcReader.

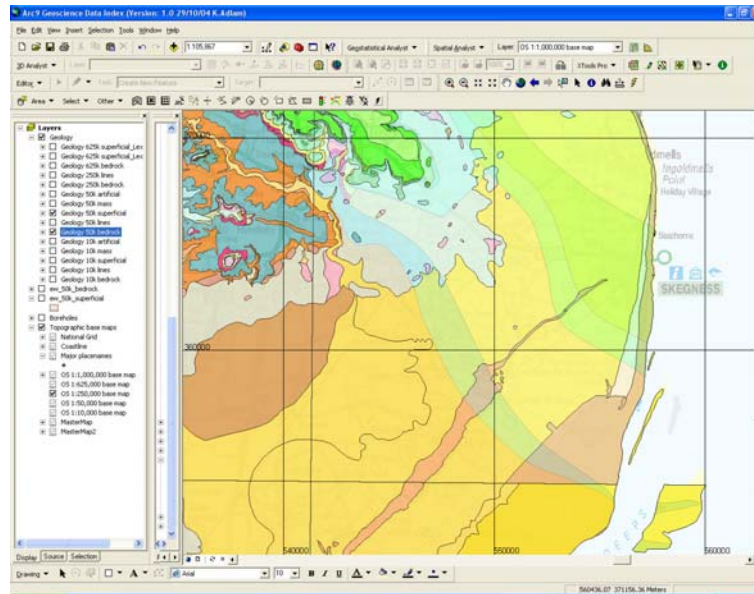


Figure 1 An example of geological and topographical data displayed in a GIS

Printed BGS geological maps of the study area

Geological publications providing details of the geology of the study area

- BGS sheet explanations
- BGS memoirs
- Georeports for relevant points within the study area.

General text books

- The Atlas of climate change: Mapping the World's greatest Challenge. 2006. Dow, K & Downing, T.E. Earthscan.
- World Atlas of Natural Hazards. M^cGuire, B., Burton, P., Kilburn, C., Willetts, O. 2005. Oxford University Press.
- Integration of natural hazards, risk and climate change in spatial planning practices. Schmidt-Thomé, P. 2006. Geological Survey of Finland.

Geohazard and climate change reports/ journal articles

- Implications of climate change for hazardous ground conditions in the UK (2004) Forster, A Culshaw, M.G. Geology Today Vol. 20 pt/no 2, p. 61-67.
- Coastal effects of climate change. Pearson, S.G., Rees, J.G. (2006). Coastal effects of climate change. Earthwise, No 23, p 24-25.

- Geohazards, Climate Change and You. (2002). Forster, A. Teaching Earth Sciences Vol 27, No 2, p41-47.

Relevant press releases e.g.

- Draft Climate Change Bill Published. <http://www.defra.gov.uk/news/latest/2007/climate-0313.htm>
- How I made my area greener. <http://www.bbc.co.uk/dna/actionnetwork/A3669889>

Environmental data

- Rainfall data
- Sea level data

Relevant webpages in PDF format

- BBC Climate Change experiment results - <http://www.bbc.co.uk/sn/climateexperiment/>
- BBC news – climate change stories (heat waves, floods, landslides) – e.g. www.bbc.co.uk/climate/ and http://news.bbc.co.uk/1/hi/sci/tech/portal/climate_change/default.stm
- UK Climate Impacts Programme website - <http://www.ukcip.org.uk/>
- Environment Agency website - <http://www.environment-agency.gov.uk/>
- Natural England website - <http://www.naturalengland.org.uk/>
- IPCC website - <http://www.ipcc.ch/>
- New Scientist Climate change news articles - <http://environment.newscientist.com/channel/earth/climate-change/>
- DEFRA website - <http://www.defra.gov.uk/>
- Tyndall Centre Website - <http://www.tyndall.ac.uk/index.shtml>

2.5 SKILLS GAINED

Team working skills

Experience of using a Geographical Information System (GIS)

Experience of reading and interpreting a geological map

Understanding of geohazards and their relationship with changes in climate

Understanding of Climate Change

Report writing

3 Proposal 2: Carbon Footprint

3.1 BACKGROUND

The Issue: Carbon Footprint is a measure of the impact human activities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide. If individuals learn to change their habits to reduce their footprint, human impact on climate can be decreased.

Since the Kyoto agreement was negotiated in 1997, there has been increased concern surrounding the release of greenhouse gases in the atmosphere. Greenhouse gases act as a blanket and trap solar radiation in the lower atmosphere, oceans and land surface. Carbon dioxide (CO₂) is one of the most significant of these gases; it is produced naturally by plants as part of the growing process, photosynthesis. Anthropogenic (man-made) activities add to this output particularly by burning fossil carbon-based fuels such as coal and oil. Research shows that CO₂ levels are among the highest they have been in the last 2 million years, and have consistently risen since the industrial revolution in the late 18th Century. One way of preventing this level from rising even further is to reduce energy use by humans. A measure of this can be established by looking at the “Carbon Footprint” of individuals, families and communities.

3.2 AIMS AND OBJECTIVES

Part 1: Calculating your schools carbon footprint

The primary aim of this task is to get the competitor to establish the carbon footprint of their school. A carbon footprint calculator should be used to assess this. For example, the Microsoft compatible offline personal carbon footprint calculator available at carbonfootprint.com, which runs on Microsoft Excel.

Figure 2 The carbon footprint calculator (www.carbonfootprint.com)

Part 2: Reducing your schools carbon footprint

Having done this they should look to establish ways to reduce the footprint of their school and report their recommendations, including pros and cons in the form of a written report.

Ways of reducing the carbon footprint that should be reviewed and assessed for implication include:

Electricity

- Turn off lights and computers when not in use
- Reduce the amount of time the central heating is on and turning it down.
- Install cavity wall installation and loft insulation
- Turn down the hot water temperature
- Install energy saving lightbulbs
- Change to a green electricity supplier

Travel

- Walk to school rather than travelling in the car
- Set up a car sharing scheme for staff or use local transport
- Use biodiesel in your cars
- Do not travel by air on school trips

Food

- Only have school meals that use in-season and food produced locally

Water

- Recycle grey (used) water
- Collect rainwater

Recycling

- Recycle general waste (glass, plastic, paper)
- Install a compost bin to recycle food waste

Offsetting

- Planting trees

Part 3: Re-calculating your carbon footprint

Finally the carbon footprint should be recalculated based on implementation of the recommended changes.

3.3 TIMING

It is suggested that the competitors are given 1 day to complete this challenge.

3.4 DATA AND TOOLS PROVIDED

A carbon footprint calculator

Relevant webpages in PDF format

- www.carbonfootprint.com
- www.carbontrust.co.uk

Relevant documents

- Assessing the energy us in your building fact sheet (Carbon Trust)
- The Better Business Guide to Energy Saving (Carbon Trust)
- A Carbon Trust Energy Saver Starter Pack

3.5 SKILLS GAINED

Team working skills

Knowledge of carbon emissions and carbon footprint

Experience of decision making

Report writing

4 Proposal 3: Energy - resources and security of supply

4.1 BACKGROUND

The Issue: The world is consuming an ever increasing amount of resources to produce energy for industry, communities and transport. These resources are finite. However, emerging technologies, including carbon sequestration, clean coal technologies and energy saving initiatives could assist in reducing or mitigating of the use of carbon based fossil fuels.

The world is consuming an ever increasing amount of resources, but these resources are finite. The use of carbon based fossil fuels also adds significantly to the amount of CO₂ output into the atmosphere. There is a huge increase in fossil fuel consumption in China and India as their economies become more industrialised. The problem could be mitigated by the use of carbon free energy production from nuclear power plants. The UK currently plans to go down this route in conjunction with the development of renewable energy. However, there are other emerging technologies that could assist in the reduction or mitigate the use of carbon based fossil fuels. These include carbon sequestration, clean coal technologies and energy saving initiatives and carbon offsetting. Increasing reliance on energy resources from politically unstable regions could threaten the security of national energy supplies.

4.2 AIMS AND OBJECTIVES

The aim of this challenge is to assess the impact on the UK of the scenarios outlined above. The competitor should establish the pros and cons of the currently available technologies and research potential alternatives. They should also assess whether more can be done concerning energy conservation and discuss how this could be publicised.

4.3 TIMING

It is suggested that the competitors are given 1 day to complete this challenge.

4.4 DATA AND TOOLS PROVIDED

Energy resources consumption data

Relative costs of current technologies

Mitigating technology information

Biofuels information

Relevant webpages in PDF format

- Sustainable Energy Resources Group www.serg-info.org/
- BBC website - www.bbc.co.uk/schools/gcsebitesize
- Joint Energy Security of Supply Working Group - www.dti.gov.uk
- Energy Review - www.dti.gov.uk
- Energy Security and Climate Change - www.fco.gov.uk

4.5 SKILLS GAINED

Team working skills

Experience of using a Geographical Information System (GIS)

Experience of reading and interpreting scientific data

Understanding of climate change, fossil fuels and mitigation of, or reduction in, carbon emissions

Report writing

5 Proposal 4: Biodiversity & Geology

5.1 BACKGROUND

The Issue: Many modern developments in agriculture, industry and the urbanisation process threaten the range of habitats in the UK, diluting the country's biodiversity. Local Biodiversity Action Plans (LBAPs) are being devised to provide guidelines on how to reduce these impacts.

Many modern developments in agriculture and industry and the urbanisation process threaten the range of habitats in the UK. The potential loss of habitats could dilute the biodiversity within the UK. However, the threat can be mitigated or reversed by a number of simple measures, such as increased headland deployment or increased hedgerow area. Ironically, climate change could increase the number of habitats and species within the UK. The UK European Union has introduced laws to protect wildlife and even taken the step to re-establish previously extinct animal species such as the European Wolf. Some extinction is natural, for example the loss of the Elm tree to Dutch elm disease spread by the Elm bark beetle. However, since 1967 25 million elms have died in southern Britain due to a more virulent strain being introduced in imported timber from the USA. Should we have spent resources on eradicating the beetle to save the Elm?



Figure 3 Sand and gravel extraction has a major impact on existing habitats, but it also creates new ones.

5.2 AIMS AND OBJECTIVES

Part 1: Biodiversity audit.

Production of a biodiversity audit using aerial photography. This is a basic report outlining the different habitats within the local community, for example: Woodland; Open Landscapes with Ancient Trees; Hedgerows; Acid / Chalk Grassland; Heathland; Grassland; Marshland; Rivers, streams and canals; Water bodies; Parks and churchyards; Farmland.

Part 2: Local Biodiversity Action Plan

What simple actions could be carried, or legislation put in place, to increase the biodiversity in your area? The competitors should create a Local Biodiversity Action Plan (LBAP) to outline the local priorities and the appropriate actions.

5.3 TIMING

It is suggested that the competitors are given 1 day to complete this challenge.

5.4 DATA AND TOOLS PROVIDED

Geological maps

Ordnance Survey topographic maps

Aerial photography

Habitat information

Examples of existing LBAPs

Relevant webpages in PDF format

- The UK Biodiversity Action Plan website (www.ukbap.org.uk)
- The Environment Agency (www.environment-agency.gov.uk)
- Centre for Ecology and Hydrology (www.ceh.ac.uk/sci_programmes/Monitoring.html)
- Biological Records Centre (www.brc.ac.uk/)
- National Biodiversity Network (www.nbn.org.uk/)
- UK Environmental Change Network (www.ecn.ac.uk/)
- UK Butterfly Monitoring Scheme (www.ukbms.org/)
- European Commission – Environment (ec.europa.eu/environment/)

5.5 SKILLS GAINED

Team working skills

Experience of using topographical and geological maps

Experience of using aerial photography

Experience of reading and interpreting scientific data

Increased understanding of biodiversity issues in your community

Report (Biodiversity audit and LBAP) writing

6 Proposal 5: Land Use Conflict and Natural Resources

6.1 BACKGROUND

The Issue: All developments require natural resources. Often these resources have to be transported across the country. Understanding of the local resources available, and using them efficiently, is extremely valuable, both in terms of monetary cost and environmental impact.

The UK economy continues to grow and an increasing area is subject to urbanisation and the expansion of transport infrastructure. All developments require natural resources such as sand, gravel and limestone for concrete and oil for plastics. Wood is currently making a comeback as a building material. Many of these natural resources are costly to transport across the nation. Most need planning permission to allow their exploitation.



Figure 4 Housing construction requires various natural resources.

6.2 AIMS AND OBJECTIVES

Part 1: Produce a resource and environmental audit. The aim is to produce an audit of the natural resources in the local area. It should establish which resources are in plentiful supply and which are scarce or absent.

Part 2: Produce an action plan for a local/regional community to illustrate the pressures for on various part of the community such as agriculture, urban communities and transport. Establish a plan to develop these resources in the most efficient and logical way to ensure the best use is made of the resources for the neighbourhood/region and the environment.

6.3 TIMING

It is suggested that the competitors are given 1 day to complete this challenge.

6.4 DATA AND TOOLS PROVIDED

A GIS

Environmental sensitivity/impact study

Order of work

Planning regulations

Relevant documents

- van Kooten, G. C. 1993. Management of Public Lands for Multiple Use. In *Land Resource Economics and Sustainable Development: Economic Policies and the Common Good*, 363-391. Vancouver: UBC Press.

Relevant webpages in PDF format

- Resolving ecological conflict (www.ceh.ac.uk)
- When City and Country Clash (www.farmfoundation.org)
- Regulating Conflict on the Urban Fringe (www.ingentaconnect.com)
- BBC (www.bbc.co.uk/scotland/education/int/geog/limestone/landuse/conflict)
- Britain Beneath Our Feet (www.bgs.ac.uk)
- Environmental guidelines for sand and gravel extraction (www.dpi.vic.gov.au)
- Sustainable Development – the Governments approach (www.sustainable-development.gov.uk/progress/national)
- Mineral extraction in Quaternary landforms and deposits (<http://www.snh.org.uk>)

6.5 SKILLS GAINED

Team working skills

Experience of using a Geographical Information System (GIS)

Experience of reading and interpreting a geological map

Increased understanding of geological resources in the UK

Report writing