National Centre for Resilience / Natural Hazards Partnership workshop:

Briefing pack

9.30 – 15.00, Thursday 19 November
BGS, Murchison House, W Mains Rd, Edinburgh EH9 3LA
National Centre for Resilience / Natural Hazards Partnership workshop on 19 November: Workshop agenda

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<td>Date</td>
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Aims of the day
The purpose of the day’s workshop is to:

1. Develop and test aspects of the NCR Natural Hazards work stream.
2. Review existing guidance notes for landslides to make it relevant for Scotland.
3. Gain feedback on the Daily Hazard Assessment (DHA) content and format.
4. Consider requirements for satellite-derived data and services in the realm of resilience, with a focus on the opportunities and barriers.

Agenda

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<td>9.00 – 9.30</td>
<td>Delegates arrive – Refreshments on arrival and opportunity for networking</td>
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<td>9.30 – 9.45</td>
<td>Welcome &amp; Introduction by Alessia Morris (Scottish Government)</td>
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<td>9.45 – 11.00</td>
<td>Session 1: Daily Hazard Assessment</td>
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<td>Tea / coffee break</td>
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<td>11.15 – 12.30</td>
<td>Session 2: Landslides factsheet</td>
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<td>12.30 – 13.15</td>
<td>Working lunch and opportunity for networking</td>
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<td>13.15 – 14.30</td>
<td>Session 3: Satellite derives data and services</td>
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<td>14.30 – 15.00</td>
<td>Wash-up session, facilitated by Alessia Morris and Jim Sharp (Met Office)</td>
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<td>• Overview of outputs from the day</td>
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<td>• Reiterate how everything discussed today will help shape future NCR operations</td>
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<td>• Next steps</td>
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<td>15.00</td>
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Briefing material
You will have received a briefing pack ahead of this workshop. Inside you will have found:

- A cover note documenting the proposed outcomes of the day, and how we arrived here
- An example of the DHA
- An example of the UK Geohazards Note on landslides
- An example of the Science Briefing on landslides
- An overview of SSGP and its objectives

We ask that you familiarise yourself with this content ahead of the workshop so that we can maximise the time available and dive straight into discussions on the day.

Challenge
To help us achieve the best possible outcome for you, we are challenging the Scottish responder community and relevant policy leads to challenge us.

Please come along to the workshop armed with questions, ideas or suggestions.

This is your opportunity to shape the future of the National Centre for Resilience and the way natural hazards are managed in Scotland.

The feedback you provide today will be used to revitalise some of the published materials currently available and include issues unique to Scotland, and to recognise new opportunities to explore.
Welcome

Thank you for agreeing to participate in the National Centre for Resilience (NCR) / Natural Hazards Partnership (NHP) workshop at the British Geological Survey (BGS) premises in Edinburgh on 19 November 2015. This workshop is aimed at Scottish Government policy leads and responders. The purpose is to review a range of data and information products currently available in Scotland, and identify how they could be tailored to better meet Scotland’s resilience needs.

This briefing note contains useful background information that will be discussed during the workshop. We ask that you familiarise yourself with this content ahead of the workshop so that we can maximise the time available and dive straight into discussions on the day.

Aim

The aim of this workshop is to develop and test aspects of the NCR Natural Hazards work stream. We will achieve this by:

1. Requesting feedback on the Daily Hazard Assessment (DHA) content and format.
2. Reviewing NHP NCR responder draft factsheets for landslides to make it relevant for Scotland.
3. Considering requirements for satellite-derived data and services in the realm of resilience, with a focus on the opportunities and barriers.

Background to the workshop


Since then the NRC Project Team within Scottish Government has been progressing development work at a pace to move the NCR from concept to implementation. More information about the implementation process can be found here: - [http://www.readyscotland.org/ncr/](http://www.readyscotland.org/ncr/)

The NCR has also recently received renewed impetus as a result of Dr Aileen McLeod, Minister for Environment, Climate Change and Land Reform meeting with local leaders and key delivery partners at the Crichton Campus, Dumfries. You can find the full press release at :- [http://news.scotland.gov.uk/News/National-Centre-for-Resilience-progress-1da4.aspx](http://news.scotland.gov.uk/News/National-Centre-for-Resilience-progress-1da4.aspx). This event included formal Ministerial agreement of the Centre’s suite of early deliverables. At this time the idea for a workshop designed to verify these deliverables was raised, which has culminated in today’s workshop.
The early outputs from the Centre are envisioned to improve our resilience to natural hazards by:

- Scoping possible service developments and additional capabilities, for early implementation by the NCR. This could include generic information/tool kits for individual hazards (winds, flooding, landslide, wildfires), e.g. science notes/fact-sheets on their impact and what to do during an event
- Review of the current forecasting systems and consideration of how existing systems and outputs can be enhanced to support wider use and therefore improve preparedness and response. Consistency, harmonisation and interoperability of, for example, hazard assessments and definitions are important

Overview of discussion topics
During the day you will have the opportunity to discuss three different topics. An overview of each is provided below:

Daily Hazard Assessment (DHA)
One of the first products launched by the Natural Hazards Partnership (NHP) following their inception in 2011 was the Daily Hazards Assessment (DHA). It is the aim of the Partnership to provide fully coordinated impact-based natural hazards advice for emergency responders and the UK government (and Devolved Administrations). The DHA was designed to help deliver this goal.

The DHA has now been in circulation for 2 years, and is available via the Hazard Manager and Resilience Direct. The question is does it meet your needs?

In this pack you will find an example of the DHA for you to review.

Landslides factsheet
The British Geological Survey has published a number of factsheets and science briefing sheets on geohazards that could affect the UK, including landslides. The aim of the factsheets and science briefing sheets is that they provide a useful source of information about each hazard, and are available at http://www.bgs.ac.uk/research/earthHazards/geohazardNotes.html & http://www.bgs.ac.uk/downloads/browse.cfm?sec=9&cat=166. The information provided in the factsheets and science briefing sheets aims to provide a high-level overview of what the geohazard is, why each geohazard occurs, what triggers them, what are the consequences of it occurring, how are they monitored, and where do they occur.

Scotland’s unique geography and its remoteness means that benefits could be gained from tailoring a factsheet to Scotland. This is your opportunity to identify what you would like to see included in a tailored Scottish landslide factsheet. Please can you read through the landslide factsheet and landslide science briefing sheet included in this pack (which aim to cover the whole of the UK) and consider aspects including: which style of document did you find the most informative and helpful; what information is currently missing; what scale of information would be helpful; do the landslide case studies add value; would guidance on response help.
Satellite derived data and services

Space offers a wealth of data and information that can support resilience activities. The UK Space Agency’s Space for Smarter Government Programme (SSGP) is currently working with departments/organisations across the UK’s public sector to exploit the opportunities from space, and help overcome any barriers.

Today’s workshop will focus on extracting your specific resilience needs in Scotland, and unveil some of the misconceptions surrounding space. It will also encourage you to think about how space could provide solutions through considering real-world examples. It will culminate in helping you create a wish list of the various space applications you would like to see embedded in the NCR to enhance capabilities including monitoring activities and keeping staff safe when in the field.

The SSGP team will be able to use this knowledge to formulate an action plan to potentially turn the wish list into a reality through a range of mechanisms, including facilitating cross-government collaboration and funding projects which meet your specific requirements through open competition.

In this pack you will find an overview of SSGP.
Daily Hazard Assessment

Issued 13:57 on Monday, 09 November 2015

The Daily Hazard Assessment is intended to provide an ‘at a glance’ top level overview only. The links provided to the relevant Partner Organisations should then be used to obtain further and more detailed information as required.

Hazards Five-Day Summary – FLOOD: YELLOW; LANDSLIDES: YELLOW; RAIN: YELLOW; WIND: YELLOW.

**FLOOD:** The highest overall flood risk for the UK over the next five days is LOW. There is a medium likelihood of minor river and/or surface water flooding impacts in north Wales, parts of Yorkshire and Central Scotland and Tayside on Monday. There is a medium likelihood of minor river flooding continuing on Tuesday in York and some other parts of Yorkshire.

**LANDSLIDES:** Recent heavy rainfall has left much of the UK with saturated ground conditions. Continued and prolonged heavy rain is forecast on the already saturated ground making the chances of landslides more likely, particularly for the regions of Northwest Scotland, Northeast Scotland, West Scotland, East Scotland, Southern Scotland, Northwest England and Northeast England.

**RAIN:** Heavy rain is forecast for parts of northwest Wales, northern England and central Scotland today.

**WIND:** After a lull today, winds will increase again this evening to bring gusts of 50-60 mph in places, with 70 mph over higher levels.

Hazards Five-Day Summary Maps

<table>
<thead>
<tr>
<th>Monday 09-Nov</th>
<th>Tuesday 10-Nov</th>
<th>Wednesday 11-Nov</th>
<th>Thursday 12-Nov</th>
<th>Friday 13-Nov</th>
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These maps provide an ‘at a glance’ indication of the natural hazards that could occur over the next five days. The area covered by each ellipse is indicative only to alert the user to which areas of the UK are at risk of a hazard. More detailed information will be found using the links.
**Natural Hazards Partnership**

**Daily Hazard Assessment**

provided. The highest level of alert will be shown, but each ellipse could indicate more than one hazard. For non-area specific hazards, the alert level is indicated by a coloured rectangle underneath the maps. Please see user guide on Hazard Manager for further detail.

**Hazards Five-Day Summary Detail**

**FLOOD:** The Met Office is forecasting heavy rain at times during Monday over northern parts of England and southern Scotland.

For England and Wales the Flood Guidance statement (FGS) from the Flood Forecasting Centre (FFC) states, “The flood risk is LOW in parts of north Wales and North and West Yorkshire today (Monday) due to a medium likelihood of minor impacts from river and surface water flooding. The medium likelihood of minor river flooding continues into Tuesday in York and some other parts of North and West Yorkshire. Further rainfall is likely over the north of Wales and the north of England on Wednesday and, as rivers in these places have become responsive to further rainfall, consequently there is a low likelihood of river and surface water flooding. Strong winds and leaf fall will exacerbate the surface water flood risk this week.”

For Scotland the FGS states, “Outbreaks of rain over southern half of Scotland will extend northwards during Monday afternoon and evening with rain continuing in the west well into Tuesday. The heaviest rainfall will be over Lochaber, Argyll and Central on Monday evening. Drier, less windy weather will follow from the northwest later on Tuesday and Wednesday before more very wet and very windy weather develops later Thursday. Turning showery on Friday with chance of severe gales.”

For further detail on the Flood Forecasts please check the FFC and SFFS Flood Guidance Statements or view them through Hazard Manager following the link below.

- **Hazard Manager**
  [http://www.metoffice.gov.uk/publicsector/hazardmanager/access](http://www.metoffice.gov.uk/publicsector/hazardmanager/access)

- **Met Office - UK Weather Warnings**

For health impacts of all hazards please see:


**LANDSLIDES:** Recent heavy rainfall has left much of the UK with saturated ground conditions. Continued and prolonged heavy rain is forecast on the already saturated ground making the chances of landslides more likely, particularly for the regions of Northwest Scotland, Northeast Scotland, West Scotland, East Scotland, Southern Scotland, Northwest England and Northeast England. These are likely to be in the form of reactivation of existing failures but new events may occur. Coastal landslides and rockfalls are also possible.

Please refer to the BGS Landslides website for further information on landslide potential [http://www.bgs.ac.uk/landslides](http://www.bgs.ac.uk/landslides).

**RAIN:** Another bout of rain is expected to fall over western parts of northwest Wales as well as Yorkshire through much of Monday, mainly over the high ground here with little rain to the east. Following wet weather over the weekend rivers are likely to rise in response to this rainfall with a low risk of localised flooding. With the rain falling on wet ground some localised flooding away from rivers is also possible.

Rain will also become persistent later this afternoon and will continue through the evening across central Scotland. The rain will be accompanied by strengthening southwesterly winds. Standing water will bring difficult driving conditions, and some localised flooding brings the risk of some minor travel disruption.
WIND: After a lull today, winds will increase again this evening to bring gusts of 50-60 mph in places, with 70 mph over higher levels.

The public should be aware of difficult driving conditions and the risk of disruption to traffic, especially across trans-Pennine routes.

Ongoing Issues

Nil.

Summary of Recent Event/Hazards

Nothing to report.

General weather outlook for the next 30 days

The mild but unsettled and often windy weather is expected to continue into next week. The wettest and windiest conditions are most likely to affect the north, with some drier weather for the south: a split that looks to largely prevail through the period. Temperatures will start on the mild side but trend to nearer average.

For more detailed information, see the Met Office UK weather forecast:

Natural Hazards Partnership
Daily Hazard Assessment

<table>
<thead>
<tr>
<th>Colour State</th>
<th>5-day UK (unless otherwise stated) Hazard Impact Assessment</th>
<th>5-day UK (unless otherwise stated) Hazard Forecast</th>
<th>UK Reported only Hazards</th>
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<tr>
<td>Green</td>
<td>Weather: rainfall, wind, ice, snow, fog, lightning, hail</td>
<td>Space weather (Earth impact forecast)</td>
<td>Extreme Temperatures (Public Health England only)</td>
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<td></td>
<td>Flooding: river, tidal, coastal, surface water, groundwater (England, Wales &amp; Scotland only)</td>
<td>Landslide (24-hour forecast)</td>
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<td></td>
<td>Volcanic Ash: disruptive</td>
<td>Wildfire: landslide, ash not expected</td>
<td>Air Quality: low air pollution levels</td>
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<tr>
<td>Yellow²</td>
<td>Disruptive flooding not expected or low likelihood of minor disruption</td>
<td>No significant space weather event(s) expected</td>
<td>Low air pollution levels</td>
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<td></td>
<td>Disruptive volcanic ash not expected or low likelihood of minor disruption</td>
<td>Landslides are not likely and there are no reports of landslides</td>
<td>Elevated wildfire conditions not forecast (low levels of wildfire)</td>
</tr>
<tr>
<td>Amber²</td>
<td>Low likelihood of significantly disruptive weather or minor disruption expected</td>
<td>Elevated volcanic ash is not expected or low likelihood of minor disruption</td>
<td>Moderate likelihood of threshold conditions being reached or exceeded</td>
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<td>Red³</td>
<td>Likelihood of significantly disruptive weather</td>
<td>Severe weather event(s) expected</td>
<td>Severe wildfire conditions</td>
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<td>Likelihood of significantly disruptive flooding</td>
<td>Increased likelihood (or reports) of multiple landslides</td>
<td>High likelihood of high air pollution levels forecast</td>
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<td>Likelihood of significantly disruptive volcanic ash</td>
<td>High confidence of extreme weather event(s)</td>
<td>High confidence of severe disruptive wildfire(s)</td>
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★ Ongoing hazard assessment recorded under “Ongoing Issues” or updated as appropriate.

1 Limited/localised hazard impact or low confidence in assessment of severity/location of hazard event
2 Significant potential for hazard event impacting large numbers of people
3 Hazards impacting large numbers of people across multiple sectors and high confidence in assessment of severity/location of hazard event
Why do landslides occur?
If the force of gravity acting on a slope exceeds the strength of the material forming the slope, then the slope will fail and movement occurs. External factors, such as weather conditions, can result in the reduction or increase in the strength of the slope.

What are the consequences of it occurring?
This is largely dependent on the location and proximity to assets (e.g. settlements, infrastructure etc), landslide type, speed of event, magnitude and frequency of landslide movement(s). Rockfalls and flows tend to be more rapid than other types and as such may represent a greater geohazard in terms of the amount of energy released.

Costs are to local councils, the Highways Agency, Network Rail, insurance companies, businesses and individuals.

Types of landslide
There are five kinematically distinct types of landslide identified by Varnes (1978) and Dikau et al. (1996):

a) Falls: A fall starts with the detachment of soil or rock from a steep slope along a surface on which little or no shear displacement takes place. The material then descends largely by falling, bouncing or rolling.

b) Topples: A topple is similar to a fall except that it involves the forward rotation, out of the slope, of a mass of soil and/or rock about a point or axis below the centre of gravity of the displaced mass.

c) Slides: A slide is the downslope movement of a soil or rock mass on a distinct slide or shear surface, occurring dominantly on the surface of rupture or relatively thin zones of intense shear strain.
These can be rotational or translational depending on the geology, structure and hydrogeology. Rotational slides involve a semicircular shear surface. Translational slides usually occur on planar slip surfaces.

d) Flows: A flow is a spatially continuous movement in which shear surfaces are short lived, closely spaced and usually not preserved after the event. The distribution of velocities in the displacing mass resembles that in a viscous fluid.

e) Spreads: Lateral spreading is characterised by the low-angled slopes involved and the unusual form and rate of movement. A spread is an extension of a cohesive soil or rock mass combined with a general subsidence of the fractured mass of cohesive material into softer underlying material. The rupture surface is not a surface of intense shear. Spreads may result from liquefaction or flow (and extrusion) of the softer material.

Varnes (1978) also presented a sixth mode of movement: complex failures. These are failures in which one of the five types of movement described above is followed by another type (or several types). For such cases the name of the initial type of movement should be followed by the next type of movement: e.g. rockfall debris flow (WP/ WLI, 1990).

In reality, almost all landslides involve more than one type of movement either concurrently in different parts of the failure or evolving downslope over time into different failures.

Susceptible locations

The British Geological Survey (BGS) National Landslide Database holds information on over 15 000 landslide events in Great Britain. Inland areas susceptible to landsliding include the Pennines, North Yorkshire, the South Wales Coalfield and debris flows in mountainous areas such as the Highlands of Scotland. Many of these landslides are linked to the last glaciation and are now heavily degraded and stabilised; others are still active.

The south and east ‘soft rock’ coasts of England have geology that is sufficiently weak to be affected by coastal erosion. Some very large, deep-seated, active landslides are located in this area (e.g. Folkestone Warren in Kent, and Black Ven in Dorset). Other types of landslides include flows (e.g. those seen in the London Clay at Herne Bay, Kent) and falls and topples (e.g. Beachy Head, Sussex, and Portland Bill, Dorset).

BGS produces the GeoSure national dataset, which provides information about potential ground movement, including landslides, in the form of 1:50 000 scale digital maps (http://www.bgs.ac.uk/products/geosure/).

Scientific detail

Monitoring and measurement

The BGS National Landslide Database is the most extensive source of information on landslides in Great Britain. Selected information from the database is available as a free online resource as part of BGS’ online GIS — the GeoIndex. The database currently holds over 15 000 records which are continually being updated. New records are added as landslide information is made available. These data come from a variety of sources including published BGS geological maps and active surveys. Other sources include commissioned and research studies, information from the public and a number of regional databases inherited or compiled by BGS since the 1970s.
including the Department of the Environment (DoE) National Landslide Database constructed in the 1990s. Each landslide is documented as fully as possible with information on location, name, size and dimensions, landslide type, trigger, damage caused, movement date, age and with a full bibliographic reference. The database is linked to a GIS which displays the landslides as point data. The way in which landslides have been mapped by BGS over the centuries has evolved and improved considerably. Many of the maps display the landslide deposit and no other information; many early maps do not make reference to ‘landslips’ at all. With modern landslide mapping techniques, landslides are now being mapped and documented in areas previously unknown e.g. the North York Moors.

Terrestrial Light Detection and Ranging (LiDAR) is a technique used by a land-based laser scanner which, combined with a highly accurate differential GPS, enables BGS to produce 3D computer models of landslides. Using several scans made at different times, we can accurately calculate volume change and can ascertain far more information about how the cliff or landslide is changing than is possible from traditional levelling or photographic techniques.

A landslide observatory has been established by BGS at Hollin Hill, North Yorkshire, which incorporates several technologies including terrestrial and aerial LiDAR and geophysics. The observatory has a weather station, instrumented boreholes, movement gauges and geophysical data is sent back to the office telemetrically.

How is the hazard characterised?

BGS does not record ‘severity’ of landslides in the same way that earthquakes are characterised by magnitude. The ‘severity’ of a landslide would depend on its size, speed and location in terms of economic impact such as damage to human life or assets. These are all recorded in the BGS National Landslide Database, but landslides are not ranked according to their severity, although some statistics involving impact could be determined from the database.

Landslides can cause secondary hazards such as, for example, fire if utilities such as gas were disrupted. Landslides can be a secondary hazard of flooding or earthquakes.

Triggering mechanisms

Landslides can be triggered by:
- rainfall
- snowmelt
- poor drainage of the slope
- oversteepening of the slope
- removal of material at the toe of the slope (e.g. coastal erosion or man-made cutting)
- addition of water on the slope (e.g. man-made ponds)
- loading of the slope (additional weight to the upper slope)
- structural or lithological weaknesses

Scenarios for future events

Predictions of increased rainfall, storminess and sea-level rise in association with climate change, are likely to result in the reactivation of currently stabilised or dormant landslides and an increase in first-time landslides such as debris flows. Slope

Monitoring and response by BGS

When a significant landslide is reported, the BGS Landslide Response Team (a core team of engineering geologists, geologists and geomorphologists who specialise in landslides) is sent to assess it. They collect data for the National Landslide Database to underpin scientific research, and provide local advice. They will speak to the media and publish a web page as soon as possible describing the event. BGS has various landslide data including the National Landslide Database, 1:10 000 and 1:50 000 scale digital geological maps of mass movements (DiGMap50 and DiGMap10) and a national digital dataset of areas susceptible to landsliding (GeoSure).
UK Examples

Holbeck Hall landslide, Scarborough, North Yorkshire, England

The Holbeck Hall Hotel was destroyed as a result of a landslide that took place over a period between the 3rd and 5th of June 1993. Following an unusually wet period in May, a pre-existing (relict) landslide reactivated and began to move downslope, the bulk of the movement taking place overnight. The foundation of the hotel was partially undermined and most of the structure of the hotel subsequently collapsed. The remains of the hotel were later demolished. The movement of the slide and collapse of the hotel was sufficiently slow to allow residents to be evacuated and electricity and gas supplies to be switched off before they caused fire.

St Dogmaels landslide, Pembrokeshire, Wales

On 14th February 1994, landsliding was reported on slopes above the village of St Dogmaels. This landslide followed a period of heavy rainfall. Although the landslide appeared to be slow-moving and did not immediately threaten the village, provisions were made to implement the local emergency plan, which involved evacuating the village. This preparation was led by the police with the support of other emergency services and the military. On advice from engineering geologists, it was decided not to implement the emergency plan, although people from houses located on the landslide were evacuated. Several houses were severely affected and damage was caused to an 11 kV power line and to water mains supplies. In the event, the landslide did not affect the main village.

Nefyn landslide, Lleyn Peninsula, North Wales

On 2nd January 2001, a fatal landslide occurred in the coastal village of Nefyn. A series of small slides swept two cars over the cliff and onto the beach below. Tragically one of the occupants was killed and another seriously injured in the incident. Nefyn Bay is between Penrhyn Nefyn and Penrhyn Bodeilas and has been subject to minor landsliding activity for many years. The landslides of January 2001 occurred after a period of heavy rainfall along a stretch of coast that comprises weak superficial deposits. The amount of water and the weak nature of the deposits contributed to the instability.
movements may be seen across the country and the effects of these may have an economic impact.

Some communities are built on old, large, slow moving landslides, such as Ventnor on the Isle of Wight or parts of Lyme Regis in Dorset. A worst case scenario event would be for a landslide such as these to undergo rapid movement. This would most likely cause a large economic loss locally and potentially loss of life.

References

Further information
The BGS Landslides team can be contacted by:
Email – landslides@bgs.ac.uk
Telephone – 0115 936 3143

More about BGS digital products (http://www.bgs.ac.uk/products/home.html)
More about landslides (http://www.bgs.ac.uk/science/landUseAndDevelopment/landslides/nld.html)
At the BGS we’re experts in the location and properties of different rocks and soils. We know that mud- and clay-rich rocks are most susceptible to landslides and we also know where these rocks occur in the UK and how deep they are. Using this knowledge we have built a National Susceptibility Map for landslides as part of our GeoSure dataset. Whilst it can’t predict the size of the event or when it will occur, the map does highlight areas where the right factors are present (rock type, steepness of the slope) and there is increased susceptibility for landslides. This digital dataset is a licensed product that anyone can buy and use, including local authorities and asset managers. This enables users to identify areas that could be affected by landslide events, especially those which could potential cause damage to infrastructure, such as railways, roads, buildings, gas lines and electricity stations.

Do you know which type rocks are more susceptible to landslides?

Rainfall has a major part to play in increasing an area’s susceptibility to landslides. When a slope has too much water in it, the weight of the water exceeds the amount that the rocks and soils can support and gravitation forces take over. The slope will then fail causing a landslide. In 2012 the UK experienced a very wet summer and winter. During this time we saw a direct correlation between an increase in the number of landslides and an increased amount of rainfall. During July and December there was a five-fold increase in the number of landslides compared with previous years. The graph on the right shows the clear correlation.

Can you predict landslides?

At the BGS we’re using our wealth of experience and expert knowledge to move towards forecasting when a landslide event is more likely to happen. One of the ways we’re doing this is by using cutting-edge techniques to monitor and study landslides at test sites around the UK. Understanding the different triggers and combinations of events that lead to landslides is the prime objective of landslide research. Our research is part of wider collaboration with other institutes as part of the Natural Hazard Partnership. We’re looking at defining thresholds relating to weather patterns, areas affected, and type and size of events all over the UK. This work is in its infancy but it’s an exciting and increasingly important area of research for UK science.
What are landslides and what causes them?

Rainfall and landslides

Met Office statistics show that 2012 was the wettest year for England and the third wettest for Wales. Overall, it was the second wettest year in the UK since national records began in 1910 (2000 saw just 6.6 mm more rainfall).

The BGS Landslides Team have been monitoring the media and scientific literature for reports of landslides since 2006 and recording them in our National Landslide Database. The extreme weather of 2012 resulted in a fivefold increase in landslides and slope failures (landslides on man-made slopes such as railway embankments), particularly during the months of July and December.

Landslides occurring after the periods of higher than average rainfall are commonly shallow in nature and likely to result from one or more of the following:

- water loading of the slope
- reduction in soil strength
- removal of soil particles or other material changing the slope

Landslides and people

Following extreme rainfall events like those in 2012, we see an increasing number of landslides occurring on engineered and man-made slopes such as railway embankments, particularly during the months of July and December.

Landslides occurring after the periods of higher than average rainfall are commonly shallow in nature and likely to result from one or more of the following:

- water loading of the slope
- reduction in soil strength
- removal of soil particles or other material changing the slope

Increased susceptibility. Large mitigation measures can also be constructed through ‘hard engineering’ solutions; examples include large gabion baskets or retaining walls. They will strengthen and stabilise a slope and are often seen around the coast and along road and rail routes.

More information: www.bgs.ac.uk/landslides
Contact Dr Claire Dashwood, Applied Geomorphologist, BGS: clforster@bgs.ac.uk

Sections of the South Coast Path have been temporarily closed to allow geologists to assess the hazards. Ground cracks along cliff edges may indicate danger of instability and should not be approached. Taken 26 Feb 2012.

The British Geological Surveys’ initial findings suggest the recent heavy rain was a contributing factor that caused the rock fall at Barton Bradstock. Taken 25 Feb 2012.

The British Geological Surveys’ Landslide Response Team map the collapsed cliff from a safe distance using Terrestrial Laser Scanning technology. Taken 25 Feb 2012.

The British Geological Surveys’ Landslide Response Team map the collapsed cliff from a safe distance using Terrestrial Laser Scanning technology. Taken 25 Feb 2012.
Overview of the Space for Smarter Government Programme (SSGP)

Introduction
The Space for Smarter Government Programme, or SSGP, is an ambitious change programme working at the heart of the UK’s public sector. We work with government departments and their affiliated organisations to help them realise the range of opportunities from embracing satellite-enabled products and services. In addition to this we run a number of competitions each year where project teams from industry and academia can bid to deliver services that solve some of the biggest challenges the public sector faces.

Who are we?
The Programme was established by the UK Space Agency in 2014. It is led and delivered in collaboration with the Satellite Applications Catapult, and as such is well placed to be the driving force for change, working alongside both the public and private sectors. There are currently no other entities working across both sectors to identify synergies, and which can deliver market growth and reduce duplication of effort.

One of our main focuses at present is on working to encourage cross-government collaboration. We are doing this through offering our support and facilitating a number of cross-government working groups on topics such as Earth Observation and remotely piloted aircraft systems (RPAS).

We are also funding a number of projects, who are working closely with the public sector, to deliver both feasibility studies and prototype services. The goal of these projects is to deliver a service that can be rolled out to the public sector and used in day-to-day activities. To date these have focused on specific topics such as environment and natural hazards risk management, and working with Local Authorities and the Devolved Administrations.

Satellite applications in the public sector
Satellite-enabled products and services are a valuable, yet largely untapped, resource for the public sector. The diversity of what’s on offer is huge, encompassing Earth Observation (EO), satellite communications (sat comms) and position, navigation and timing (PNT).

In this time of austerity, satellite applications offer innovative solutions to common needs. This in turn enables more insightful and effective policy decisions to be made and delivers efficiency savings, whilst helping the UK’s space sector to grow.

Why does this matter?
Now is the perfect time for the public sector to seize the opportunities on offer from space. Rapid advances in technology are leading to the exponential growth of the space sector, which is leading to the increased availability of accessible data. Embracing these opportunities now will generate enormous benefits for the UK, and enable it to be at the forefront of this technological revolution. The UK itself is already a leader in the field, and has a goal to represent 10% of the global space market by 2030.
The ultimate goal of this Programme is to remove the barriers to uptake and make space invisible: for it to underpin business as usual practices, for it to be the technology of choice in the design of new and innovative solutions, and for it to be recognised as the powerhouse it truly is.

Opportunities for resilience in Scotland
We focus our efforts on the following tasks to fulfil the Programme’s vision of making space accessible:

- Supporting cross government collaboration
- Forming partnerships with potential end users from the public sector to achieve a joint strategic vision on key focal areas
- Running competitions to develop space-enabled solutions from concept to operational which meet specific requirements
- Creating a network of champions to ensure the Programme’s legacy lives on

We are here in Scotland today to see how we can incorporate the resilience community in Scotland in this endeavour, and deliver some of the benefits already being experienced by others in the public sector.

Preparation for the workshop
The workshop will look at the following:

- What are your greatest priorities in the field of resilience?
- What do you think are the biggest opportunities from space, and what is preventing you from taking advantage of this technology?
- What are the next steps to put space within reach?

Additionally, to bring satellites to life a real-world example from Scotland will be examined. The intention is to identify if and how satellites could have played a role to aid the response, and enabled more effective decisions to be made. And also to consider why they weren’t used at the time.

In the meantime, please have a think about your data requirements for different hazard types e.g. floods, forest fires etc. Also considered whether you would have different requirements during the various phases of the disaster management cycle i.e. preparation, response, recovery, mitigation.

Contact us
To find more information about our Programme visit the SSGP website at http://spaceforsmartergovernment.uk/. Alternatively, please email ssgp@sa.catapult.org.uk and a member of the team will get back to you.

More information
In preparation for this session you may find it useful to investigate some of the services available during emergencies:

Disaster Charter: https://www.disasterscharter.org/web/guest/home