REPORT

Landslides in the East Midlands

Great Britain is not a country renowned for its large landslides. It lacks the extreme climatic events and the mountainous regions that are associated with catastrophic landslides events elsewhere in the world. Nevertheless, landslides in Britain do have significant societal and economic impacts. Meteorological Office statistics have shown that 2012 was the second wettest year since collation of national records began in 1910. Tragically, this also saw the highest number for many years of fatalities due to landslides, including those at Burton Bradstock in Dorset and at Looe in Cornwall. Even so, these landslides contrast with recent events in China, in Afghanistan and in Washington, USA, where large and calamitous events claimed many lives. However, landslides are common enough in Great Britain, and there is currently a heightened awareness of these geological hazards, and this was largely due to extensive media reports in 2012 and 2013.

Geologists at the British Geological Survey (BGS) have been collecting information on landslides as part of regional geological surveys since mapping began in 1835. A large proportion of these landslides are relicts from major environmental changes at the end of the Late Devensian glaciation, and most, but not all, currently lie dormant. The degraded nature and subdued topography of the landscape means that landslides in Great Britain are commonly not viewed as extensive or problematic, but all available information is held in the BGS National Landslide Database (NLD). By developing a database inherited from the Department of the Environment, BGS have been consistently collecting and updating the landslide data. Landslides are recorded as events (or surveys), and these enable reactivations to be recorded as they are reported. Events have been added and amended from mapping surveys, regional reports, scientific papers, university theses and unpublished reports. In addition to this, the BGS Landslides Team started to monitor the on-line news media for reports of landslides in 2006, and have incorporated the social media since 2012. The database now contains over 16,500 records of landslide events, making it the definitive source of information on landslides in Great Britain (Foster *et al*., 2012).

Landslides across Britain

The rains of 2012 and 2013 cost Britain many millions of pounds. In 2012, the country was swept by floods from heavy and persistent rain. For long periods, the ground was saturated and consequently hundreds of landslides occurred in the two years (Fig. 1). The news and social media were filled with reports of landslides, large and small. First, relatively small-scale events frequently made the headlines, as susceptible superficial sediments and weaker bedrock materials were affected; many of these caused cancellations of trains and diversions of road routes. Then, as the water percolated deeper into the ground, larger events started to occur, with impacts that were felt right across the country. Damage occurred to roads (over the Rest and Be Thankful Pass west of Loch Lomond, at Rothbury

***Figure 2**. The debris flow that dumped superficial colluvium onto the road over the Rest and Be Thankful Pass in Scotland in October 2013 (photo: BGS, NERC).*

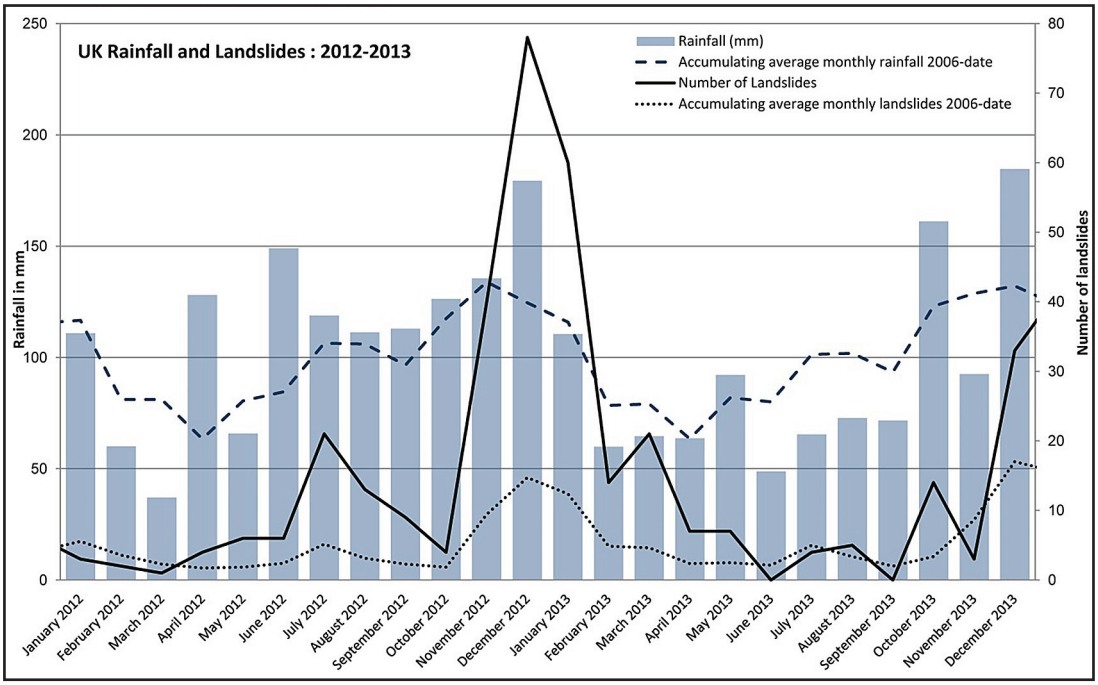

***Figure 1**. Correlation between precipitation and reported landslides (including slope failures on manmade slopes) in Britain for 2012 and 2013. Rainfall data from the Met Office; social media were incorporated into the data acquisition from August 2012 onwards.*

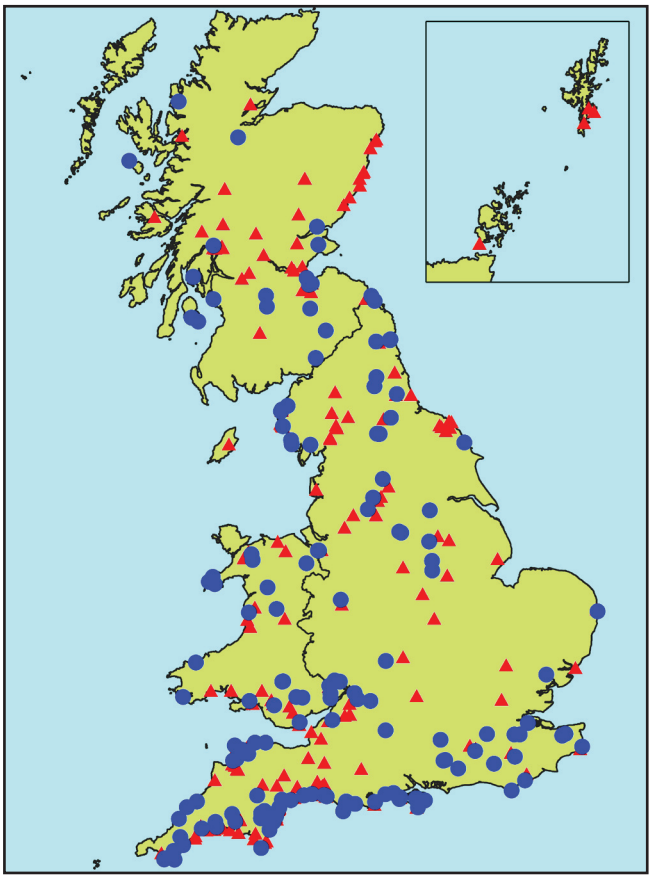

***Figure 3**. New landslide events in 2012 (red) and 2013 (blue).*

in Northumbria, and on the A614 at Ollerton), railways (at Hatfield Colliery east of Doncaster, and at Barrow upon Soar), canals (the Grand Union at Foxton) and houses (in Whitby and in Looe). Tragically four lives were lost and many more were injured.

Across the country, the number of new landslide events in 2012 recorded a fivefold increase over the long-term average (Pennington and Harrison, 2013). The BGS database currently holds records of 192 events in 2012, and 162 in 2013, but these numbers are not final and new records are still being found through archived local news reports and by external collaboration. Although landslides occurred throughout the country, the most significant numbers were recorded in Southwest England, which bore the brunt of most of the rainstorms during the period (Fig. 3).

Landslides in the East Midlands

Within the East Midlands (Nottinghamshire, Derbyshire, Leicestershire and Rutland, Lincolnshire and Northamptonshire) seven landslides were recorded in 2012 and three in 2013 (Fig. 4). All of these were classified as 'Slope Failures', in that they occurred on engineered slopes (either cuttings or embankments) rather than on natural slopes. These slope failures are mostly small-scale slumps or flows triggered by heavy rainfall, and they happen soon after periods of prolonged heavy rain. This is not to say that none occurred on natural slopes during the time period. All these events were reported in the media due to the impact they had on people, notably the disruptions of rail travel. Events may have occurred on remoter parts of the high ground in Derbyshire, but would not have been reported as they had little or no impact on society.

Of the seven new landslide events recorded by BGS in 2012 (Table 1), five were informed by social media and news reports, and the Belper failure was reported by using the BGS on-line report-a-landslide form. Four of the East Midlands 2012 failures occurred in the

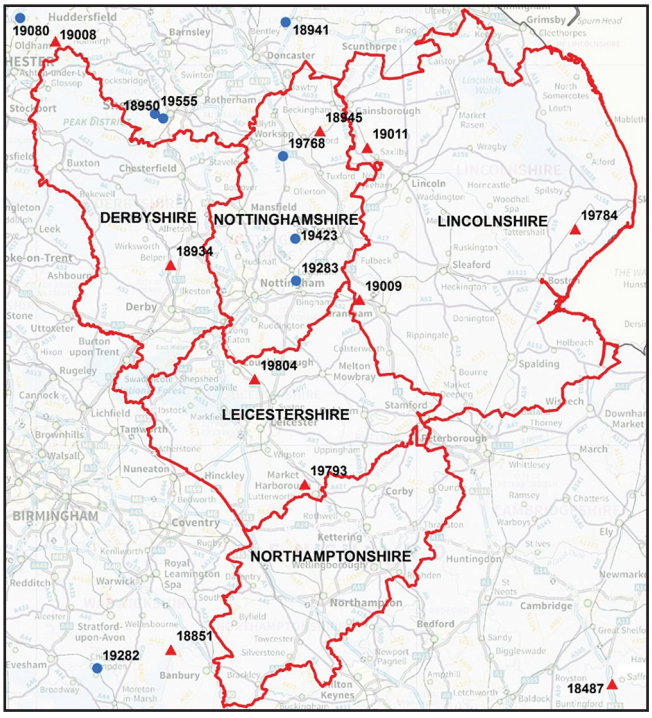

***Figure** 4. Landslide records 2012 (red triangles) and 2013 (blue circles) in the East Midlands.*

#	*event*	*NGR*	*type*	*date*	*impact*
18945	Clarborough Tunnel, near East Retford	474558E 382641N	Slope Failure (flow off bank by west portal)	27/04	Train was struck by debris, derailed at front, but coaches stayed upright. Two injuries.
19009	East Coast Railway, Allington, Grantham	485000E 338300N	Slope Failure	06/07	Railway blocked. 90 minute delays on East Coast Mainline near Allington.
19011	Railway, Saxilby to Stow Park	487000E 378300N	Slope failure (collapsed bank)	09/07	Train services between Gainsborough and Lincoln replaced by buses for one day.
18934	Belper, Parkside	435304E 347461N	Slope Failure (and retaining wall failure)	25/12	
19784	Eastville, B1184, Fodder Dyke Bank	541689E 356883N	Slope Failure	01/12	Road closed
19793	Grand Union Canal, near Foxton	470588E 289711N	Slope Failure	25/12	Canal blocked for week until dredged while repairs delayed by water-logged slope.
19804	Barrow upon Soar	457402E 317415N	Slope Failure	27/12	Rear 10 wagons of freight train derailed. Temporary suspension on fast line.

***Table 1**. Landslide events within the East Midlands that were recorded in the BGS National Landslide database in 2012*

***Table 2**. East Midlands landslide events recorded in the BGS National Landslide database in 2013.*

#	event	NGR	type	date	impact
19283	A6097, south of Gunthorpe Bridge	468315E 343252N	Rotational Failure in embankment	15/08	Road damaged; one lane closed.
19423	Halam Hill Road cutting, Southwell,	468093E 354295N	Slope Failure	01/12	
19768	A614, between Ollerton and Ranby.	464844E 376016N	Slope Failure	18/03	Damage to road and traffic delays.

***Figure 5**. The landslide failure, mainly of colliery waste, impacting the railway from Doncaster at Hatfield Colliery in February 2013 (photo: BGS, NERC).*

December after a prolonged period of heavy rainfall. On April 27th, after a week of heavy rain, landslide #18945 caught the 11.25am passenger train from Lincoln to Sheffield and beyond, though in a non-conventional sense of catching a train. The event reached the national newspapers, with reports that 17 passengers on the two-carriage train were evacuated after it came off the tracks near the Clarborough Tunnel, close to East Retford, in north Nottinghamshire. Although the front of the train was derailed by the landslide debris, the carriages remained upright.

The slope failure on the Grand Union Canal (#19793) on January 4th left dislodged material in the canal where it could not be removed immediately. Saturated land above had the potential to further destabilise the bank and cause more slippage into the canal. The canal was dredged and reopened after a closure of ten days.

In 2013 three new landslide events were recorded in the East Midlands (Table 2). Once again, all were classified as slope failures rather than landslides on natural slopes. Landslide #19283 was the failure of part of the embankment supporting the A6097 road near East Bridgford in Nottinghamshire. The bank on the southern side of the road failed over its entire height with a width of about 20 metres, and sediment had been washed out a few metres into the field below. The landslide did not damage the road surface, but was so close that traffic was restricted to a single lane past it, until the slope was remediated with steel sheet piles.

***Figure 6**. Reactivated landslide in Herefordshire (photo: BGS).*

In the context of the national landslides data for 2012 and 2013, the East Midlands did not suffer as much disruption as did other parts of the country. It is clear that the areas that experienced rainfalls that were well above average coincided with most of the reported landslides, particularly in southwest England. This highlights the importance of hydrogeological triggering as one of the main drivers of slope instability. However the East Midlands record may also be influenced by the nature of the reporting. In previous years, a small landslide that had partially blocked a minor road would be unlikely to register on a trawl of local media; but now its mention on social media is just as likely as that of a larger landslide, as people have become accustomed to communicating travel disruption via micro-blogging sites such as Twitter.

The East Midlands also includes large areas of higher ground in the Peak District, where landslide events may have gone unreported as they had no impact on local infrastructure. Typical of this is the Mam Tor landslide. Reactivations of landslides are captured in the database only when they are reported in the on-line media. Consequently the Mam Tor landslide does not feature in this report, though movements were almost certainly on a significant scale during these wet years (see *Mercian Geologist*, 2000, v15, p55). At that site the only social impact of the landslide was to increase the interest for visitors to the permanently closed road. Without exception, all the East Midlands events that were reported via social media and local news had direct impact on day-to-day lives.

Acknowledgements

The authors thank colleagues in the BGS Landslide Team for their work on the data base. This team is keen to actively engage and collect data from anyone and everyone. Please tell us about any British landslides that you have seen while out walking or driving, or have just heard about in local media. Anyone can contribute to our data collection by contacting the team via Twitter (@BGSLandslides) email (landslides@bgs.ac.uk) or our on-line report-a-landslide form (http://www.bgs.ac.uk/landslides/report.html).

References

Foster, C., Pennington, C., Culshaw, M., & Lawrie, K., 2012. The national landslide database of Great Britain: development, evolution and applications. *Environmental Earth Sciences*, **66**, 941 – 953.

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