



## The National Landslide Database of Great Britain: Acquisition, communication and the role of social media



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### ABSTRACT

The British Geological Survey (BGS) is the national geological agency for Great Britain that provides geoscientific information to government, other institutions and the public. The National Landslide Database has been developed by the BGS and is the focus for national geohazard research for landslides in Great Britain. The history and structure of the geospatial database and associated Geographical Information System (GIS) are explained, along with the future developments of the database and its applications. The database is the most extensive source of information on landslides in Great Britain with over 17,000 records of landslide events to date, each documented as fully as possible for inland, coastal and artificial slopes. Data are gathered through a range of procedures, including: incorporation of other databases; automated trawling of current and historical scientific literature and media reports; new field- and desk-based mapping technologies with digital data capture, and using citizen science through social media and other online resources. This information is invaluable for directing the investigation, prevention and mitigation of areas of unstable ground in accordance with Government planning policy guidelines. The national landslide susceptibility map (GeoSure) and a national landslide domains map currently under development, as well as regional mapping campaigns, rely heavily on the information contained within the landslide database. Assessing susceptibility to landsliding requires knowledge of the distribution of failures, an understanding of causative factors, their spatial distribution and likely impacts, whilst understanding the frequency and types of landsliding present is integral to modelling how rainfall will influence the stability of a region. Communication of landslide data through the Natural Hazard Partnership (NHP) and Hazard Impact Model contributes to national hazard mitigation and disaster risk reduction with respect to weather and climate. Daily reports of landslide potential are published by BGS through the NHP partnership and data collected for the National Landslide Database are used widely for the creation of these assessments. The National Landslide Database is freely available via an online GIS and is used by a variety of stakeholders for research purposes.

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### 1. Introduction

Great Britain does not experience extreme climatic or tectonic events, nor are there high mountainous regions associated with large scale, destructive landslides as seen elsewhere in the world. In terms of landsliding, Great Britain is a low risk environment (Gibson et al., 2013) with small scale failures and low fatality rates. Past events which represent significant impacts of landslides in Great Britain have been dominated by incidents that were large scale (e.g. Holbeck Hall, North Yorkshire; Lee, 1999), disruptive to transport routes and local economies (e.g. Rest and Be Thankful Pass, Argyll; Winter et al., 2010; Rothbury, Northumberland; British Geological Survey, 2012a) or

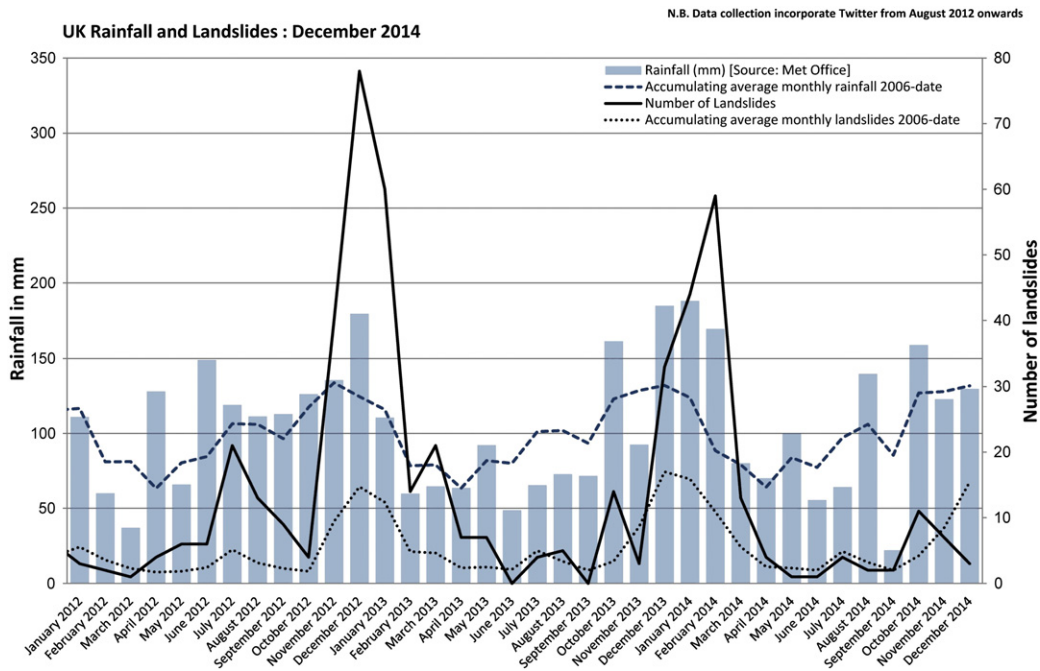
involved isolated fatalities (Burton Bradstock, Dorset; British Geological Survey, 2012b; Whitehaven, Cumbria; Jenkins and Hobbs, 2007; Nefyn Bay, Gwynedd; Gibson et al., 2002). Detailed reviews of UK landslides can be found in Jones and Lee (1994) and Cooper (2007). The winters of 2012–13 and 2013–14 and the summer of 2012 saw extensive periods of prolonged precipitation and a corresponding marked increase in the number of landslide events reported at both the coast and inland. These events had significant impacts on infrastructure and people (Pennington and Harrison, 2013; Fig. 1).

As a partner of the Natural Hazard Partnership (NHP), the British Geological Survey (BGS) has become a focus for issuing national daily hazard assessments for landslides related to weather. The collation of landslide data into a coherent national database is key to its continuing delivery of national advice and understanding of landslides in Great Britain. This paper provides an overview of the National Landslide Database in terms of traditional data acquisition methods that have been supplemented recently with the use of social media to both collect

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**Fig. 1.** UK precipitation [Source: Met Office] and reported landslides (including slope failures on manmade slopes): January 2012 to December 2014. Social media were incorporated into the data acquisition methods from August 2012 onwards.

and communicate landslide information. Additionally, current scientific research and applications are summarised.

## 2. The National Landslide Database of Great Britain

The first version of the national landslide database of Great Britain was devised by the UK Government's Department of the Environment (DoE). The production of the DoE database was a much-needed first step in identifying the extent and significance of landslides in Great Britain. The relatively subdued topography and degraded nature of many ancient failures in Great Britain had meant that landsliding was not widely considered to be extensive or problematic. However, costly disruptions to projects in the 1960s by reactivation of previously unrecognised landslides, for example, on the Sevenoaks By-pass (Skempton and Weeks, 1976) and the Walton's Wood motorway embankment (Early and Skempton, 1972) brought about a realisation that the extent of ground instability was not well understood or managed by developers or planners (Foster et al., 2012). This database documented approximately 8500 records of landslides. Since 1995, the DoE database has been incorporated into and combined with other information from a range of data sources discussed in this paper and is now superseded by the BGS National Landslide Database (NLD). The details of the history, work flow, deficiencies and how the current version of the database addresses these are detailed in Foster et al. (2012).

The BGS NLD in its current form is, to date, the most comprehensive source of information on landslides (both inland and at the coastal) and *slope failures* (although this is a term widely used, for the purposes of the NLD, it is specifically reserved for landslides on manmade slopes) in Great Britain. Data are displayed in a GIS and there are currently over 17,000 records of landslide events on both natural and manmade slopes with each landslide documented as fully as possible (Fig. 2). Each landslide record can hold information on over 35 attributes including location, date, dimensions, landslide type and style, trigger(s), impact(s), vegetation, age, development and a full bibliographic reference to the source information (Fig. 3). For detailed description of these attributes and their definitions, see Foster et al. (2012).

The database consists of a series of related tables with constraining domains held and maintained in a corporately managed relational Oracle database schema as well as in an ArcMap10 Geodatabase, with a Microsoft Access front-end. Microsoft Access is a very flexible and user-friendly front-end tool for data entry and manipulation. The back-end database held in Oracle provides: (i) security; the data are backed-up both on- and off-line and are securely held and monitored; (ii) maintenance and management; Oracle allows the use of powerful tools for the maintenance and control of the data, including the granting of levels of access down to field level; (iii) accessibility; the data are readily accessible throughout the BGS and can be readily made available on a wide variety of both on- and off-line platforms; (iv) outputs; use of Oracle Spatial© means that the spatial element of the data can be output in any coordinate system required without recourse to complex algorithms or export routines and subsequent manipulation; (v) maintenance of history and transactions; the full history of data input, and any changes, is held and can be rolled back to any point; and (vi) interoperability; the power and capacity of an organisation-wide database, such as Oracle, mean that a wide variety of datasets can be readily related to the landslide data, enhancing the potential for new science.

Each record represents a *survey* of a landslide event not a landslide per se, therefore enabling multiple reactivations of long-term continuously moving landslides to be captured in the database, which has been particularly useful in understanding the reactivation of a number of large scale landslides relating to antecedent rainfall conditions in areas such as the Isle of Wight in 2012–13 (e.g. Totland, St Lawrence and Headon Hill). Multiple movement events and surveys of the same landslide complex are captured as distinct episodes by giving each landslide record a compound unique identifier consisting of a Landslide ID and a Survey Number. Associated surveys are easily searched for in the database and displayed as separate points in the GIS.

The data are subject to a continuous Quality Assurance (QA) process and there are several integrated precision and accuracy fields that address this. For example, as the spatial extent of every landslide is not documented, each landslide record is located as point data on the highest point of the backscarp (or digital landslide polygon if backscarp information is unavailable). There are approximately 9000 landslide

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