

## Abstract

The UK is served by a wide range of digital elevation models that have a variety of technical specifications from several different vendors. The abundance of data presents researchers with a complex range of choices dependent upon their application (and therefore "fitness-for-purpose") and desired use of intellectual property rights (IPR). This poster explores current DEM data sets of the UK and presents their use within the context of claimed copyright and IPR. In particular, responsibilities placed upon grant holders for the lodgement of research outputs with UK Research Councils places new emphasis upon data access, derived data and data re-use. The complex interplay of rights between research output stakeholders (data suppliers, data creators, data users) presents a difficult scenario for both data repositories and data depositors.

## Introduction

Digital elevation models (DEM) form important input parameters for a variety of environmental modelling projects, ranging from inter-visibility analyses, through to flood modelling and tree-canopy height estimation. DEMs are therefore integral to a range of qualitative and quantitative analyses. Data sources for DEMs have traditionally been photogrammetrically derived contours, however this has more recently been supplemented with digital photogrammetry, interferometric SAR and LiDAR. All of these techniques are available, to some extent, from both airborne and satellite-borne platforms. The wide range of data (often from different vendors) derived from different techniques, using different platforms and at different dates, produces a complex "map" of available products.

The UK is perhaps the most mapped nation on Earth, with the Ordnance Survey (OS) at the forefront of high spatial and temporal resolution data acquisition (e.g. Mastermap provides object accuracy of ~1m and currency of ~6 months). With the increasing use of digital elevation data, data suppliers have made available at least nine different DEM products (including global data sets) using a variety of data acquisition techniques and consequently with varying technical specifications. The following sections outline the main DEM data sets available for the UK and places them within the context of third party copyright, licensing conditions and intellectual property rights with respect to derivative data sets.

## Digital Elevation Models

This section briefly describes the main national DEM datasets available for the UK. Table 1 displays summary information concerning these data.

The OS has two main DEM products that are available to the HE community through EDINA. These are named Panorama™ and Profile™ and are based upon 1:50,000 and 1:10,000 topographic contours respectively. A third product, called ProfilePlus™ is a composite dataset based upon contours, digital photogrammetry and LiDAR and is available commercially. Both Panorama™ and Profile™ raster DEMs are based upon interpolation from the original contours.

Intermap's NEXTMap product is based upon airborne interferometric SAR (InSAR), offering significantly better modelling of the terrain surface than any other current national product. It primarily competes with LiDAR, offering economic survey costs, however it is unable to penetrate vegetation and, in general, has lower vertical accuracies.

Landmap is a DEM created by an academic group (Muller *et al*, 2000) in the UK free from any third-party licensing using spaceborne InSAR. Utilising ERS-1/2 tandem data, the DEM was produced using strips rather than individual scenes.

The Shuttle Radar Topography Mission (SRTM; Rabus *et al*, 2003), a NASA Space Shuttle mission, created a DEM of the world from 56°S to 60°N. SRTM also used spaceborne InSAR and, uniquely, carried *two* sets of sensors on board.

| Product                      | Creator       | Nominal Resolution (m) | Relative Vertical Accuracy (m) | Acquisition Technique     | Acquisition Date      |            |
|------------------------------|---------------|------------------------|--------------------------------|---------------------------|-----------------------|------------|
| Panorama®                    | OS            | 50                     | 5                              | Contours                  | Maintained until 2002 |            |
| Profile®                     | OS            | 10                     | 5                              |                           | Maintained            |            |
| ProfilePlus®                 | OS            | Variable               | Variable                       | Multiple                  | Maintained and Mixed  |            |
| NEXTMap                      | Intermap      | 5                      | 1                              | InSAR (airborne)          | 2002-03               |            |
|                              | Intermap      | 10                     | 1                              | InSAR (airborne)          | 2002-03               |            |
| Landmap                      | JISC          | 25                     | 20                             | Tandem InSAR (spaceborne) | 1995-96               |            |
| SRTM:                        |               |                        |                                | InSAR (spaceborne)        |                       |            |
|                              | C-Band – 30 m | NASA                   | 30                             | 6                         |                       | 11/02/2000 |
|                              | C-Band – 90 m | NASA                   | 90                             | 6                         |                       | 11/02/2000 |
|                              | X-Band        | DLR                    | 25                             | 6                         |                       | 11/02/2000 |
| LiDAR (limited availability) | Various       | 0.5 – 5                | 0.10 - 0.25                    | LiDAR                     | Variable              |            |

Table 1 National DEM data products of the UK. LiDAR is included for comparison; whilst not available nationally, large parts of the country are covered.

## Derived Data

It gets worse !!!!

If you **derive** any of your data from an OS data source (e.g. Panorama™) then it **inherits** the same copyright restrictions. That is to say:

- no data redistribution
- publication restrictions
- if you cease to license the source data you **must** destroy all derived data

The (quantitatively derived) probability surface in Figure 1 is derived from Panorama™ and so falls into this category. The sub-glacial bedforms mapped in Figure 2 have been *interpreted* (qualitatively derived) from the underlying Panorama™ data, however the inheritance of copyright remains.

**Q.** Should qualitative/quantitative derivation alter the interpretation/restrictions of derived data?

Intermap include a clause in their license for output that cannot be reverse-engineered to the original source data; this is termed *thematic* output and is free from the inheritance of copyright

## GRADE Project

Research Councils UK (2005) now require the deposition of research outputs from grant holders; this includes publications and data. EDINA is currently scoping the legal, social and technical aspects of establishing a geospatial data repository (GRADE Project; www.edina.ac.uk/projects/grade).

• The legal (IPR) related work unit has produced a compendium of examples in the use of geospatial data (Smith, 2005) and this has been used as a basis to explore the legal framework (e.g. copyright, database directive) that operates between stakeholders in geospatial data output.

• The technical work unit is currently trialling an online repository demonstrator (www.edina.ac.uk/projects/grade).

## Conclusions

• Derived data products form a fundamental "enabler" in the use, distribution and re-use of research.

• Research Councils UK require the lodgement of research "outputs" (both publications and "results" in the form of derived data)

• JISC-OS license is academically restrictive in that research output based upon original and derived OS data are effectively **not publishable** in any journal. Full IPR are also claimed.

• The GRADE Project is currently exploring the social, technical and legal contexts to the establishment of geospatial data repositories.

• Metadata forms a key component in allowing researchers to discover data provenance and assess fitness-for-purpose.

## References

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- Rabus, B., Eineder, M., Roth, A. and Bamler, R., 2003. The shuttle radar topography mission—a new class of digital elevation models acquired by spaceborne radar. *Journal of Photogrammetry and Remote Sensing*, 57: 241-262.
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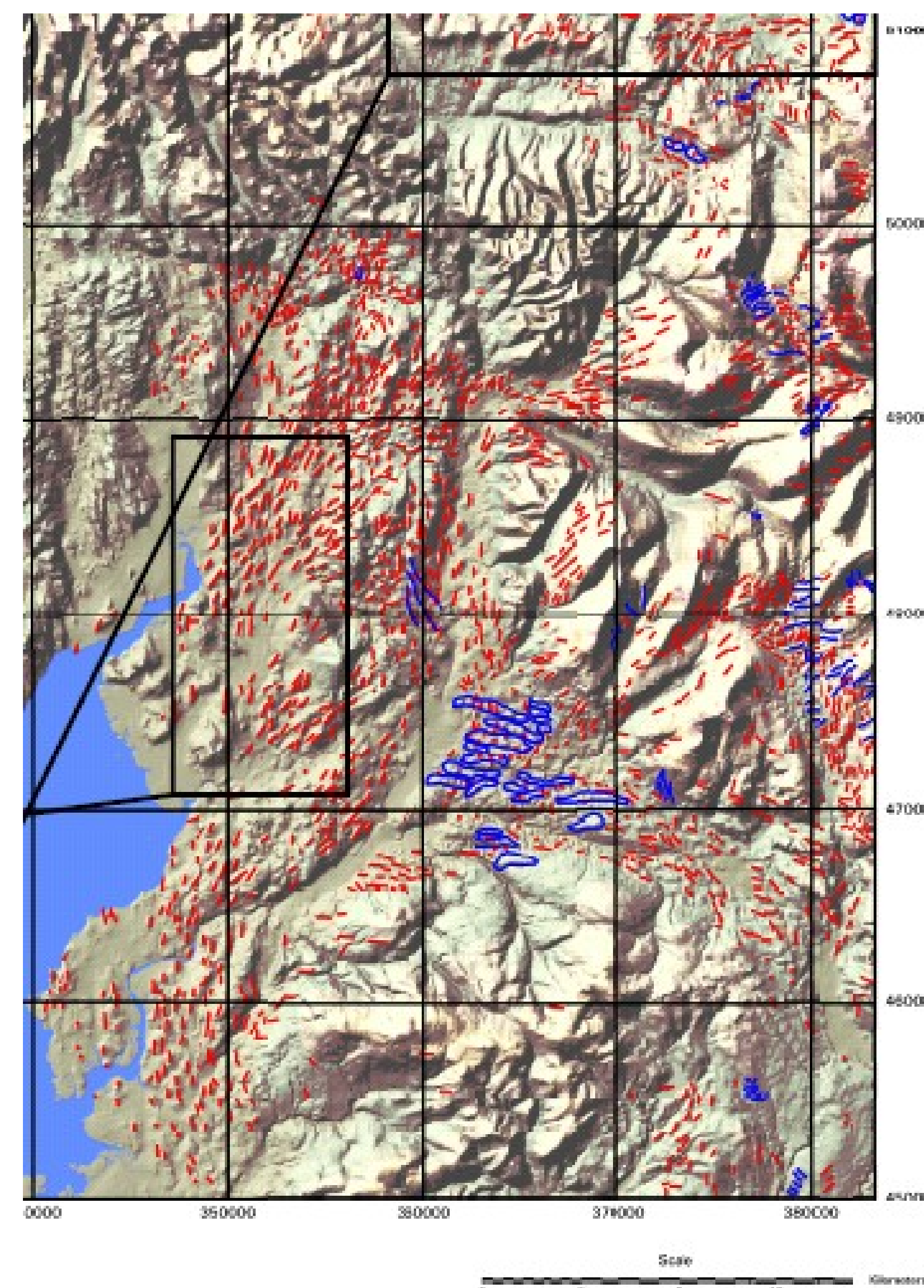


Figure 2 Sub-glacial bedforms mapped from, and displayed on top of, OS Panorama™

These belonged to NASA (C-band) and DLR/ASI (X-band) and have been processed/distributed separately. The latter was able to operate at a higher level of accuracy but only covered ~50% of the area of the NASA sensor.

It should be noted that spaceborne sensors are routinely used to collect stereoscopic data, subsequently being processed into DEMs (e.g. SPOT5, ASTER), however coverage is limited.

## Copyright: third party

Research outputs can only be published or distributed within copyright restrictions of any incorporated third party data. Data (in the US) collected at the federal level is typically copyright free (e.g. SRTM, Landsat) which allows unrestricted use within other products.

The Ordnance Survey has historically been the predominant supplier of DEM data. For HE institutions this is usually supplied by EDINA (under a JISC-OS license). Use of OS data in posters and presentations is relatively open. For instance I can legally 'show' Figure 2, which is based on Panorama™, Colour Raster, Meridian2™, Strategi®, as part of this poster.

However, the map cannot be 'published'. All electronic, internet facing maps come with very stringent restrictions based upon:

- maximum size of individual image
- maximum ground area

This varies by product but generally means that any map **larger** than A5 is unpublishable.

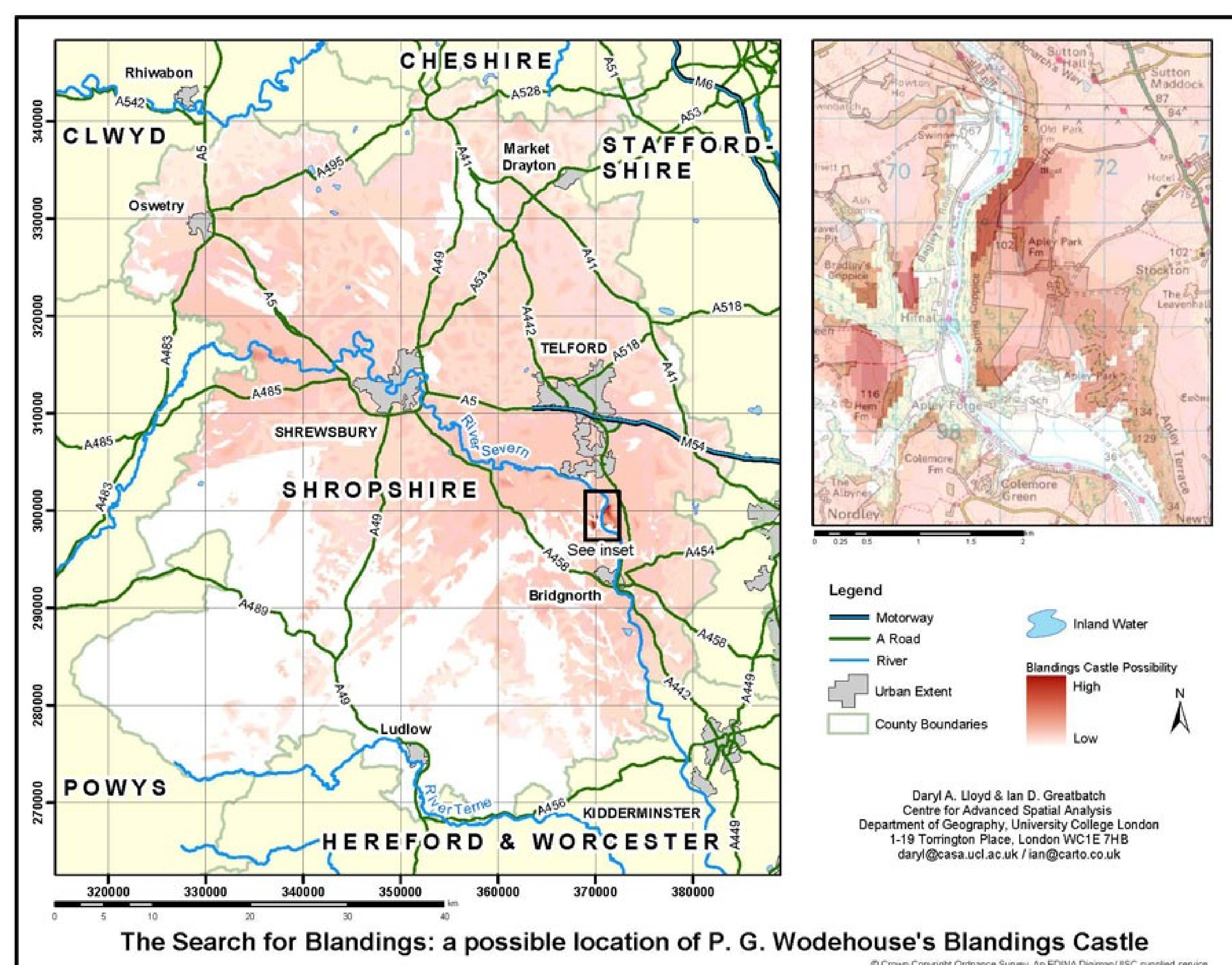


Figure 1 The search for Blandings. An example of a map that can be 'shown' as part of a presentation but NOT published

## About the author

Dr Mike Smith is Senior Lecturer in GIS at Kingston University and Editor of the Journal of Maps