A Spatial Perspective:
One Scotland, One Geography – One Historic Environment?

Peter McKeague

Royal Commission on the Ancient and Historical Monuments of Scotland, Edinburgh
Peter.mckeague@rcahms.gov.uk

Abstract

This paper explores issues facing those who curate information about the archaeological and built heritage of Scotland within the context of developing Scottish and European requirements for delivering best value from geographic-based data. Adoption of the INSPIRE Directive by the European Union and the development of national GI strategies combined with emerging web mapping and feature services will enable greater access to spatial data but also highlight the need for a definitive national dataset representing the known extents of the cultural heritage.

1. Introduction

The internet and, particularly, web services offer new possibilities for the organisation and delivery of data reaching out to a far wider range of users than could ever have been imagined.

The public is well served by accessibility to information from central and local government, academic institutions and other organisations. Yet spatially the same richness in heritage information is potentially confusing to the non-specialist users.

A review of spatial data requirements is pertinent on two counts. Firstly the European Union has adopted the INSPIRE Directive (European Communities 2007) which addresses the use of environmental information in Geographic Information Systems. Secondly, web mapping and web feature services offer new solutions to problems in delivering information to remote users. In April 2008, The Scottish Government launched the Scottish Rural Development Programme. The programme provides financial assistance to farmers to encourage environmental stewardship of their land based on a number of key criteria including archaeological and natural heritage assets and constraints. Currently applicants have to seek information from specialist information repositories separately although, in time individual knowledge bases could and should provide definitive data for their sector through live web mapping services into a single bespoke portal. It is only a matter of time before remote portals for e-planning advice, similar to Planning 360 being developed in England and Wales, invoke web map services from a host of contributors including the historic and natural environment sectors. In anticipation of the statutory requirements imposed through the eventual adoption of the INSPIRE Directive through legislation enacted by the Scottish government and the practicalities of delivering information to remote services, the heritage agencies in Scotland need to streamline the organisation of data across central and local government to present a clearer record of the nation's heritage to the end user.

From a spatial perspective, information is currently presented by dataset on an organisational basis. Yet the user – the public – is primarily interested in what can be found at a location and what, if any, constraints apply. Whether that information comes from central or local government is incidental unless there is a requirement to consult further information, such as original archive material, held offline. Rather there should be a single geographic representation of information that signposts additional resources and constraints.

2. The European and Scottish perspectives on spatial data management

In Spring 2007, the INSPIRE Directive was adopted by the European Union. INSPIRE sets down the general rules of governance to establish an infrastructure for spatial information in Europe for the purposes of Community environmental policies and policies or activities which may have an impact on the environment although with clear implications

and benefits to other sectors such as agriculture, transport and energy.

The Directive is based upon the following key principles. Data should be collected once and maintained at the level where this can be done most effectively and that spatial data should be collected at one level of Government and shared between all levels. There is the ability to combine seamlessly spatial data from different sources and share it between many users and applications. Spatial data needed for good governance should be available on conditions that are not restricting its extensive use and that it should be easy to discover which spatial data is available, to evaluate its fitness for purpose, and to know which conditions apply to its use. INSPIRE builds upon the infrastructures already under development in individual member states. The Directive does not require collection of new spatial data (however there are implications in organising information and ensuring consistency with other datasets) nor does it affect the Intellectual Property Rights of the data owner (Vickers 2007).

The motives behind INSPIRE seek to reduce duplication and fragmentation of data and encourage networked services to enable data discovery, together with viewing, downloading, transformation and the ability to invoke additional remote services. The Directive defines 34 Spatial Data themes grouped into three annexes. Spatial Data specifications are more stringent for Annex I and Annex II than Annex III. The Protected Places theme in Annex I is open to interpretation as either referring to the narrow definition of statutory designations or a wider, more embracing interpretation describing the totality of the archaeological and built heritage both onshore and offshore. Either way, requirements for INSPIRE compliant data will be equally applicable to all data. The implementation of INPSIRE is a lengthy process. After two years of preparatory work the Directive is now in the Transposition phase, with a view to implementation by national governments from 2009 to 2013. That is, it is looking to the medium term, not the short term.

If INSPIRE sets out the European vision for spatial data, many countries and regions had already embarked on their own strategies, notably the Norwegian Norge Digitalt (Berg 2007; www.norgedigitalt.no). In 2004 the Scottish Executive published One Scotland, One Geography; setting out the Geographic Information Strategy for Scotland (Scottish Executive 2004; www.scotland.gov.uk/pub lications/2005/08/31114408/44098). One Scotland, One Geography recognises that some 80% of information held across central and local government has a geographic basis. It presents guidance to ensure wide use of such information to support the work of the government and wider public sector in Scotland. The strategy aims to deliver better and more cost-effective public services through strategic vision and leadership. It seeks to ensure access to the most up to date and accurate geographic information about Scotland and removal of the barriers to efficient and effective use of geographic information. It aims to promote appropriate technical and professional standards for use of geographic information, to communicate the potential of geographic information whilst acknowledging ongoing UK, European and International activities.

Geographic information is a basic resource supporting Scotland's priorities for government – including economic and social development, education, environment and culture. The strategy seeks to ensure that all providers of geographic information share their data appropriately – including the modifications to structures and processes to remove unnecessary restrictions on data sharing.

3. Metadata and data

Underpinning both INSPIRE and One Scotland, One Geography is the need to develop a Spatial Data Infrastructure or SDI. An SDI is the technology, policies, standards, human resources and related activities necessary to acquire, process distribute, use, maintain, and preserve spatial data. Currently there are no guidelines and rules of governance for the establishment of a Scottish SDI Nevertheless with the requirements of INSPIRE and the need for an SDI in mind, it is appropriate to review how organisations involved with cultural resource management organise, present and share information both between each other and to the wider public. This review is deliberately critical. It aims to highlight how current organisational practices across the heritage sector do not adequately address issues of duplication and fragmentation of data. This is particularly the case for information delivered through the internet, where the user is presented with a wide range of resources from across all tiers of government and other institutions – but lacking a coherent definitive view of the information curated on behalf of the citizen.

At best the present situation blurs the source information, confusing the end user, – the citizen – undermining data quality and thereby usability and confidence – ultimately reducing value in the product.

The following examples illustrate the wealth of heritage information available to the user – all organised by individual resource rather than optimized to present a clear and definitive view to the user. A key tenet of INSPIRE is information discovery through Metadata. In Britain, through the GiGateway (www.GiGateway.org.uk), organisations may individually upload information about the spatial datasets they hold enabling remote users to search by organisation, location, keyword etc.

When the GiGateway service was first launched, RCAHMS added details for several spatial datasets including information mapped from field survey using differential GPS or Electronic Distance Measurement, transcribed from oblique aerial photography as well as the point data representing records held in the RCAHMS database. These are all spatial datasets that qualify or help define a record in the national geo-database. Current GIS practice is to present each layer separately, yet the mapped extents of an earthwork or the transcription of cropmark are really spatial attributes of a record in the geo-database. The ability to serve all information about a record describing a location as a single integrated web service will help reduce the apparent duplication of data to the less specialist user. Simplification of the presentation of heritage information, be it from separate data silos or from different aspects of the mapped record, is essential in considering the use of that information remotely and in combination with other datasets describing assets or constraints on an area of land. Distinction should be made between information defining the monument or landscape from that defining the constraints affecting management of the resource – be they Scheduled Monuments, Listed Buildings or Sites of Special Scientific Interest (SSSI) designated by Scottish Natural Heritage. Nevertheless there is an explicit relationship between heritage asset and the constraints that should be expressed in the hard-wired concordance between the unique reference numbers of the separate datasets rather than the reliance of spatial coincidence.

A simple search for archaeological datasets in Britain on the Higher Education node of GiGateway returns 120 datasets ranging from resource discovery metadata for local authority SMRs to project specific resources for excavations at Scalloway, Shetland and Dunadd in Argyll. Discovery level metadata will soon become unworkable if the GiGateway is flooded with entries for each and every fieldwork project undertaken.

The internet provides many ways of retrieving information through simple Google searches to bespoke portals enabling users to search for information from National or local datasets. Search interfaces present any number of possible matches to a query and users, familiar with this approach, accept the limitations. Existing web applications – such as RCAHMS' own Canmore and Canmore mapping applications, or many of the Scottish Local authorities SMRs – present information on an organisation by organisation basis whilst more sophisticated approaches use metadata standards – the Dublin Core – to search across a range of resources from individual organisations such as the Archaeology Data Service (ADS) ArchSearch catalogue. A simple search for Dunadd through ArchSearch returns 19 results – in addition to the Project archives from the 1980–1 excavations, there are 9 records each from the West of Scotland Archaeological Service (WOSAS) and RCAHMS. Refining the keyword search to 'Dunadd fort' signposts 3 results, the ADS project record, a report on a watching brief near Dunadd fort on the WOSAS SMR and the RCAHMS entry for Dunadd fort. Yet to the public and on a map base there is but one Dunadd fort.

English Heritage's Heritage Gateway performs a similar service using web services to search across a variety of online resources. Whilst the technology is impressive, results are still presented on an organisational basis leaving the user to view each result in turn rather than retrieve a single definitive description about a particular site

ArchSearch aside, there are no equivalent text based searches across multiple Scottish datasets, although with web services both RCAHMS and SMR datasets *could* be opened up to the Heritage Gateway. However through Pastmap the user has the ability to perform a number of map-based searches across the Historic Scotland Scheduled Monuments, Listed Buildings and Gardens and Designed Landscapes datasets as well as information from Canmore and four of the local authority Sites and Monuments Records – covering 70% of the country. Each dataset is presented as a separate layer and the table of results is also organised by resource – and again each resource is separately

tabbed – the user simply cannot see a single view from across national and local organisations despite the shared geography and attribution. The user has to work hard to understand how the data relate to each other. Put simply, information provision must put the user first, introducing clarity to information managed across both central and local government through the removal of ambiguity and duplication of information. The goal must be to achieve a definitive, unambiguous, informed dataset for the heritage of Scotland that can be easily used in both existing internet applications as well as new services drawing in data remotely. To do this requires a review of the roles of each tier of government in the creation and management of information.

4. The current structure of information organisation in the heritage sector in Scotland

With INSPIRE looming and in the context of One Scotland, One Geography, it is appropriate to review the data repositories – information silos – in Scotland. Nationally RCAHMS and Historic Scotland perform complementary roles in the survey and recording, protection and management of Scotland's heritage. RCAHMS maintains the national inventory and archive of the archaeology, buildings and maritime heritage of Scotland, supported through annual programmes of surveying and recording and through the deposit of primary archive – in both paper and digital form. Information is stored in an Oracle database, supported by a GIS, which holds information on over a quarter of a million sites in Scotland and over 4.5 million items of related archive.

Whilst RCAHMS maintains an inventory of the nation's heritage, Historic Scotland is the responsible agency for the statutory designation of Scheduled Monuments, Listed Buildings and wrecks and the non-statutory designation of gardens and designed landscapes. Historic Scotland maintains the records related to the designation of sites largely on Oracle databases supported by GIS. Historic Scotland field monument wardens routinely inspect and report on the condition of statutorily protected sites. Historic Scotland also performs important roles in aiding projects such as the Scottish Palaeo-environmental Archive, Scottish Wetland Archaeological Database, and the Glasgow University Geophysics database. In the museum sector, the National Museums

Scotland cares for many collections of national and international importance and promotes these to the public through their museums. It also provides advice and guidance to the wider museum community across the country.

Within local government, archaeological advice is provided by archaeologists either employed directly by each local authority, brought in from adjacent councils, from independent trusts working on behalf of the council and in one case from a commercial archaeological service. Local authority archaeologists ensure due consideration of the archaeological resource in the planning process. Each service maintains an SMR, using a commercially available database or bespoke systems usually coupled with a GIS. Content was originally derived from information held and copied from the RCAHMS database although increasingly each SMR is gradually developing its own content through site visits and casework as well as continuing to absorb data from RCAHMS as a series of annual downloads. The remit of SMRs varies across the country, and some, but by no means all, include the built heritage in their databases. Rather, building conservation officers, of which there is at least one in each local authority, are responsible for advising their respective council and members of the public on issues relating to the built historic environment. In particular, they provide advice on listed building and conservation area consent and maintain information, usually as files rather than organised in a database, on the built heritage, particularly casework, in their own areas. The Scottish Museums Council represents the interests of and advises the museum sector in Scotland including all thirty two local authorities, one hundred and sixty-two independent trusts, seven regimental and nine universities. However not all these museums have relevant collections.

Each of these organisations and representative groups in central and local government is a stakeholder in data defining and documenting the archaeological and built heritage of Scotland. Both Historic Scotland and RCAHMS share and view each other's data and exchange information – via periodic downloads – with colleagues in local government. Inevitably though, not all data is easily accessible, or consumable, from these data silos – particularly in the museum sector. Moreover fieldworkers active in commercial or research archaeology and the voluntary sector make an increasingly significant contribution to the knowledge of Scotland's heritage.

Through the internet, Pastmap delivers information to a wide audience. Developed in partnership between RCAHMS and Historic Scotland, Pastmap is an online web-GIS browser first launched in 2004 (Gillick *et al.* 2004). Pastmap provides a web-GIS browser enabling searches across a range of central and local government datasets: the spatial extents of Scheduled Monuments, and Gardens and Designed Landscapes are represented through polygons whilst the Listed Building and RCAHMS data are represented through point datasets. The SMR dataset mixes polygons defining the minimum known extents of sites with indicative polygons buffered around a given NGR. There is no agreed spatial representation for non-scheduled site extents. Information is updated by periodic downloads from individual organisations.

Pastmap presents the user with a fragmented view of the nation's heritage, reflecting organisational priorities, namely the branding and ownership of information, rather than delivering a single definitive view of the nation's heritage. The Pastmap results page presents up to five disconnected views of any given site and the user has to explore each option in turn for instance accessing a PDF copy of the Scheduled Monument documentation, viewing the information held on the RCAHMS database or from the local authority SMR website.

5. Potential streamlining of information

Instead of an increasingly over complex view of the heritage as hosted by individual organisations, current practices should be reviewed in keeping with the One Scotland, One Geography agenda, to present the public with a simplified spatial index drawing data from a range of central and local government resources via web services and through hyperlinks to additional detail. This requires the establishment and maintenance of a polygon dataset defining heritage sites across Scotland, the will to manage the concordance between records held by interested parties, and, particularly, the use of web services to provide content, including any associated spatial data, such as transcriptions of cropmarks from aerial photography or excavation locations, to a greatly simplified report page. Through careful digital rights management, sensitive information such as ownership, images and descriptions of building interiors can be restricted.

Professional users, for instance conducting environmental impact assessments or undertaking work on utilities, could also benefit from the provision of a definitive heritage dataset delivered as a web-map service straight to their GIS replacing current practice where formal application is made to each record for downloaded extracts of data. The benefits are clear for the user in accessing key up-to-date-spatial information drawn from the live database integrated into their own GIS systems when they need it rather than the current process of requesting data for specific study areas. Web map services will reduce the burden on curators in handling requests for information although, on the downside, it may reduce the opportunities for dialogue and mitigation at a pre-planning application stage.

From here it is a short step to remote geo-portals, such as those required to deliver e-planning services through chaining, the process of combining information from complementary and interoperable web services, to provide the public with tailored reports. Though remote services devoid of dialogue with curators' spatial data will require enhanced attribution describing and displaying additional areas of constraint beyond the minimum known site extents.

The model depends on greater accessibility between information managed centrally and locally and the willingness to share. For instance, in developing the Heritage Environment Record database for Scottish Borders Council as an Oracle web application hosted by RCAHMS, the system stores information about site visits by the archaeological staff as well as current development control casework relating to a particular site record. Through the case file reference stored in the table, the council officer can access all the related documentation stored on the council's document management content system. With the development of a public web site, more restrictive digital rights could be applied to the data to present the remote user with a link to the publicly accessible documents on the council's Public Access to Planning.

6. Conclusions

INSPIRE signposts a radical change in the way information will be delivered to and consumed by a wide range of users. Both INSPIRE and One Scotland, One Geography data highlight the need for national datasets – inventories – and that these datasets should

be collated once and managed at the level where they can be maintained most effectively. Adherence to the standards defined by the MIDAS heritage standard are equally applicable across a range of resources or a single resource serving the country but maintained at both national and local level. However, any development needs to be underpinned by a national spatial data infrastructure for heritage providing the technical support, services and standards to a broad range of contributors across government, the commercial, academic and voluntary sectors feeding into the investigative activities.

References

Berg, Evy (2007) Using a GIS-based Database as a Platform for Cultural Heritage Management of Sites and Monuments in Norway. In: Jeffrey T. Clark and Emily M. Hagemeister (eds) *Digital Discovery. Exploring New Frontiers in Human Heritage. CAA2006. Computer Applications and Quantitative Methods in Archaeology.* Budapest: Archaeolingua, 321–7.

Gillick, Mark, Peter McKeague and Richard Strachan (2004) Online: web developments at the Royal Commission on the Ancient and Historical Monuments of Scotland and the development of a shared heritage portal with Historic Scotland'. In: Karin F. Ausserer, Wolfgang Börner, Maximilian Goriany and Lisa Karlhuber-Vöckl, L. (eds) *[Enter the Past] Proceedings of the 30th CAA conference held in Vienna, Austria, April 2003.* Oxford: BAR.

European Communities (2007) DIRECTIVE 2007/2/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) Official Journal of the European Union L 108 Volume 50 (2007), Brussels. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:108:0001:0014:EN:PDF

Scottish Executive (2004) One Scotland, One Geography: A geographic information strategy for Scotland. Edinburgh. http://www.scotland.gov.uk/Resource/Doc/57346/0016922.pdf

Tony Vickers (2007) A directive to INSPIRE. In: *GIS Professional* issue 15, April 2007, 16–18.